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ANFO—
A New Explosive for Use in Agriculture

E. K. Leggett

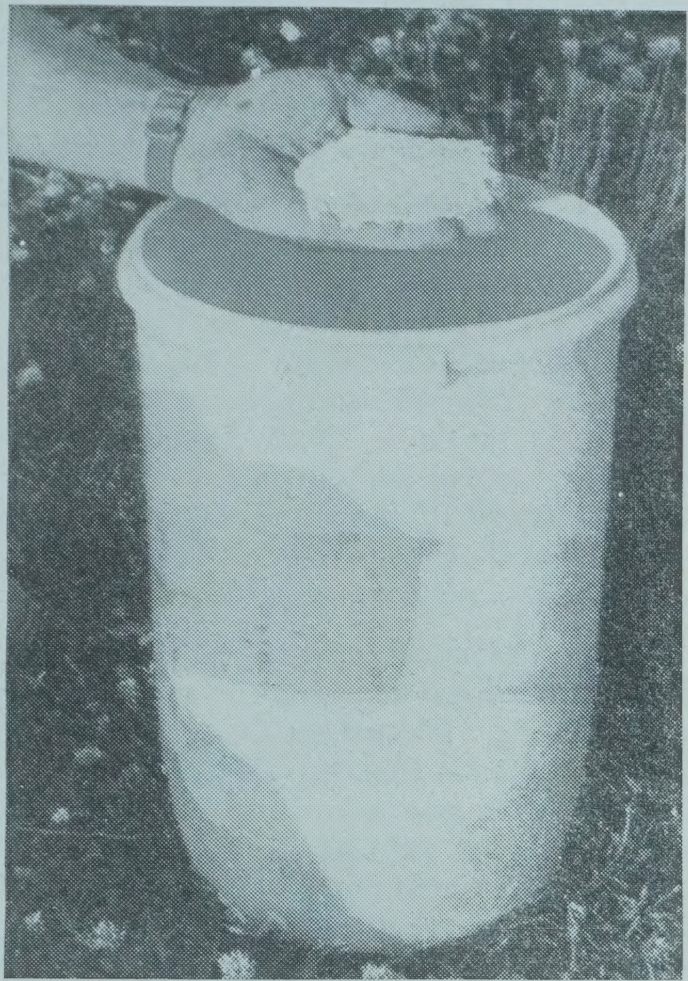
EXPLOSIVES have been used for many years in stump removal, tree felling and land drainage, but with the increased use of the bulldozer, cost factors reduced the use of explosives. With the advent of "anfo", however, a new low-cost method of stump removal and tree felling has once more aroused interest in the use of explosives in agriculture.

What is anfo?

Anfo is a mixture of ammonium nitrate and fuel oil (distillate is the commonest form of fuel oil used). Ammonium nitrate is commercially available either in a "prill" or granulated form and is used as a nitrate form of nitrogenous fertilizer. Ammonium nitrate, as such, is a relatively stable substance.

The Author: Mr. E. K. Leggett, District Agronomist, Department of Agriculture, Macksville.

A stump blasted with anfo



The prill or granulated form of anfo. Note the plastic container.

For use in anfo, only the prill form should be used.

It becomes sensitised in the presence of a carbonaceous material, and common distillate fuel oil is used as the sensitising agent in the formation of anfo.

Explosive power

Anfo mixture is regarded as, weight for weight, equivalent to AN gelignite "60" (1 in. x 8 in.), but from practical observation under conditions of good confinement in the soil, the explosive power of anfo in stump removal or tree felling appears superior to that of gelignite.

The explosion of the anfo mixture causes effects which differ with soil type, moisture status of the soil and, more particularly, the type of timber to be blown and its root system. It is possible either to shatter, loosen or remove the stump when the operator gains experience with anfo, soil conditions and the timber he is working with.

To use anfo

For clearing work with anfo mixtures, the following materials are needed:

- Ammonium nitrate—in the prill form;
- Fuel oil;
- Priming material—AN gelignite "60" (1 in. x 8 in.) is the cheapest form for general work;
- Detonators—electric or plain;
- Safety fuse—when plain detonators are used;
- Instantaneous fuse—for multiple shot firing; and
- An approved container in which to mix.

NOTE:

Under the Explosives Act, 1905—the mixing of ammonium nitrate and fuel oil constitutes the manufacture of an explosive. Readers are advised to read section termed "Explosives Act, 1905."

Approved container under these regulations means—"An approved plastic container, an approved plastic lined steel mixer or other approved device".

Method of mixing

The amount of fuel oil that is added to the ammonium nitrate to produce anfo is critical. The minimum concentration is 4 per cent and the maximum is 8 per cent (by weight).

A practical guide is to mix by volume 1 fl. oz. of fuel oil with 20 fl. oz. of ammonium nitrate.

For larger quantities, the mixture would be 5 pt. of fuel oil to 80 lb. of ammonium nitrate (one bag).

Although it is possible to obtain instant detonation of the mix, a minimum storage period of one hour is recommended for complete detonation.

Anfo becomes de-sensitised by the absorption of water, and under conditions in excess of 60 per cent humidity, moisture will be taken up. For this reason, a day's working stock of anfo should be held under conditions that will prevent moisture take-up. When soil conditions are such that moisture is excessive in the area of the prepared charge hole, use of a plastic bag to contain the charge is recommended.

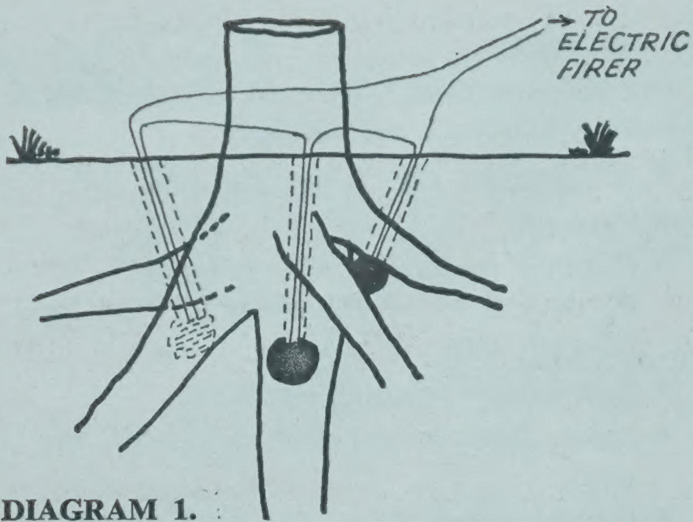


DIAGRAM 1.

A multiple charge of three shots. Layout here is for electrical firing. Note how the lead from the centre charge is joined to the outside charges, and these leads join the electrical firing cable. Avoid kinks in detonator wires and cable wires.

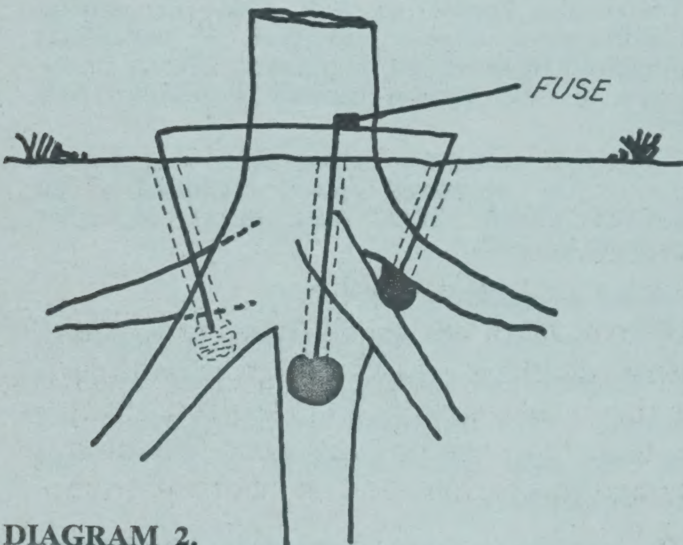
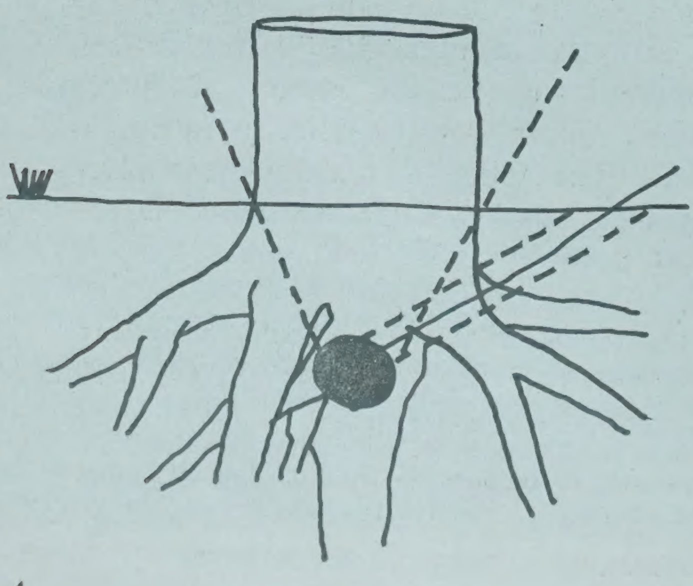


DIAGRAM 2.

The same situation as above, but for instantaneous fuse. One fuse is taken from the charge on the left, to the charge on the right. A separate fuse is cut for the centre charge. The end of the centre fuse is taped with the detonator to the other fuse line.



Preparation of charge

Gelignite is used for the priming of anfo, and as a basis for working use one half (½) plug of gelignite to each charge used.

The use of electric detonation or safety fuse and standard detonation—with or without instantaneous fuse—is up to the operator. If it is preferred to keep the detonator out of the charge hole, instantaneous fuse must be used and the detonator taped to the fuse above ground level (see picture at top left on page 7). If this method is adopted, the instantaneous fuse is simply laced through the gelignite (picture at bottom right on page 7).

The predetermined charge of anfo is either poured down the hole, or positioned in a plastic bag. The gelignite—either laced with instantaneous fuse or with electric or plain detonators inserted in the cartridge—is covered by the anfo mixture. The detonation fuse is brought out of the ground and the charge hole filled with soil and compacted firmly to confine the charge. In multiple charges, electric detonators in series or on instantaneous fuse must be used to secure the simultaneous detonation of all charges.

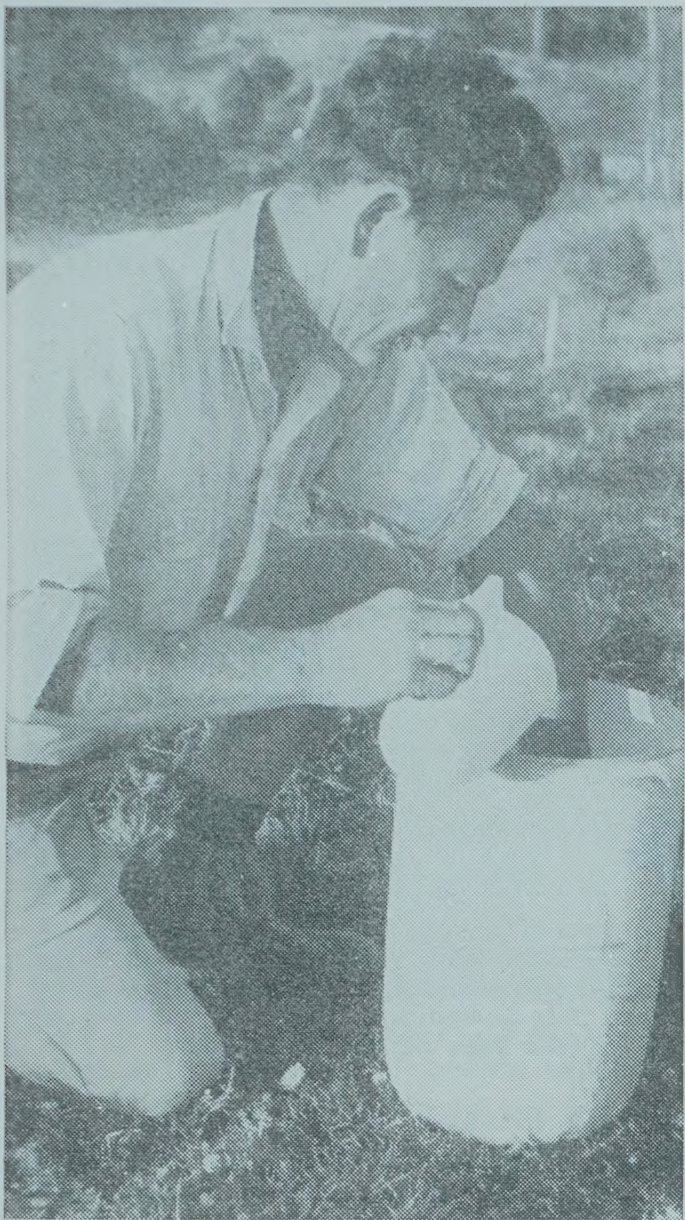
Judging quantities

As with blasting with gelignite, the standard of 1 lb. of charge to each 1 ft. diameter of the stump—measured at a height of 1 ft. above ground level—is used with anfo. With green stumps and standing green trees, or in cases where soil is very open or dry, double quantities of anfo are recommended.

Stumps up to 2 ft. in diameter are best handled by one charge located under the stump at its centre, or against the tap root, at the apex of an equilateral triangle where the base is the width of the stump at ground level (see diagram 3).

DIAGRAM 3.

In placing a single charge shot, centre the charge under the stump, at the apex of an equilateral triangle whose base is the diameter of the stump at ground level. If a heavy tap root is present, it may be better to place two charges against the tap—one on either side.



Adding fuel oil to ammonium nitrate. The mixing is here being done by hand.

With larger stumps and stumps with large side roots, multiple charges may be necessary, and the placing of these charges will be mainly a matter of experience. However, the charges should be placed where the maximum resistance is anticipated (see diagrams 1 and 2).

Cost factor

The following price structure is given for comparison. Prices are ex Sydney and ruling at the present time:

AN gelignite 60 (1 in. x 8 in.), 3s. a pound, Ammonium nitrate (prill), 7¾d. a pound.

An example of costing could be as follows:

A 6 ft. diameter stump is estimated to require three charges, each of 2 lb., for its removal.* The following table shows costs in connection with gelignite and anfo blasting.

The table clearly shows the advantage in using anfo as a means of reducing costs in land clearing.

Costs of materials needed for anfo and gelignite blasting

	Electric detonation				Safety fuse			
	Anfo		Gelignite		Anfo		Gelignite	
	s	d	s	d	s	d	s	d
Gelignite	1	6	18	0	1	6	18	0
Ammonium nitrate	3	10½	...		3	10½	...	
Electric detonator	3	0	3	0	...		...	
Standard detonator	...		...		0	1½	0	1½
Safety fuse* ...	...		...		0	6	0	6
Instantaneous fuse*	...		...		3	4	3	4
Fuel oil	0	2	...		0	2	..	
	8	6½	21	0	9	6	21	11½

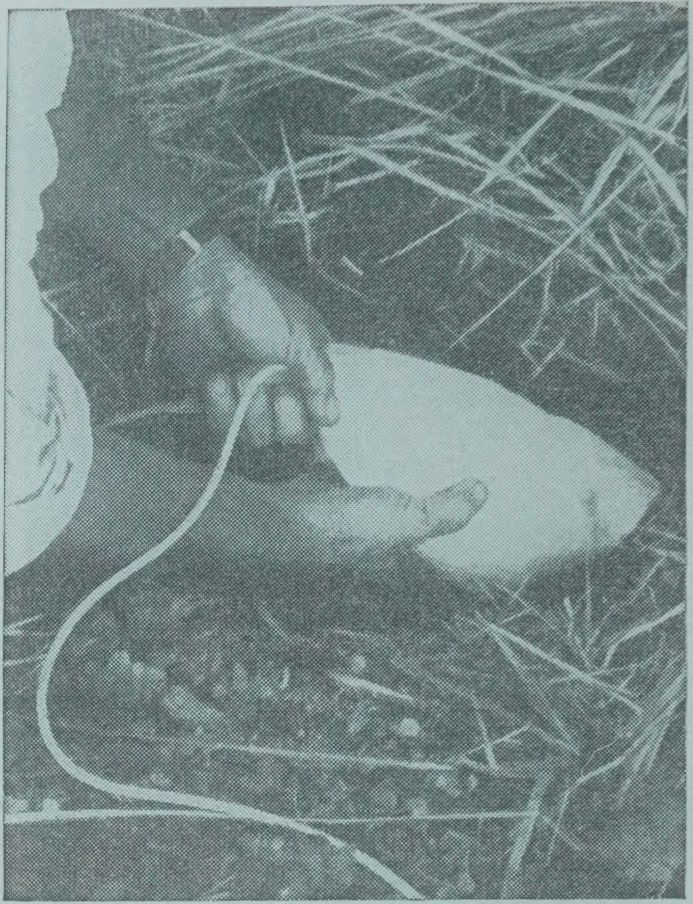
CAUTION

All explosives are highly dangerous, and farmers should be cautious when working with these substances. Before firing make sure that there is no one near the blast area, and that protection is afforded from flying debris.

One further word of warning at this point is the treatment of "misfires", should they occur. The regulations in force state that if a misfire occurs when using safety fuse a period of one hour should elapse before any action is taken, and if electric detonators are being used a period of fifteen minutes should elapse before any action is taken. The action that should take place after these respective periods have elapsed is as follows:

* The Explosives Act states that 6 ft. of fuse, or 3 minutes burning time, is required when using safety fuse. With instantaneous fuse, it is assumed that each hole requires 3 ft. of fuse and that a distance of 3 ft. will cover the multiple charge—12 ft. of fuse to be used (see diagrams 1 and 2).

Pouring anfo into a plastic bag. Gelignite primer and fuse attached are completely covered by the anfo.



A charge of anfo in a plastic bag being placed in the charge hole. Note how the instantaneous fuse will lead out of the hole. This is done where it is desired not to have a detonator at the base of the charge hole.

The stemming (packed earth) should be removed by the use of a wooden implement after first soaking the stemming with water —after the stemming only has been removed place new charges in plastic bags on top of what remains of the old charge and refire.

Explosives Act, 1905

As the mixing of ammonium nitrate and fuel oil constitutes the manufacture of an explosive under the regulations of the Act, users of anfo must apply to the Mines Department for permission to mix and use the explosive. It must be stated by whom the mixing will be done; the type of container or device for mixing and the place at which the anfo will be prepared. The following information has been supplied by the Mines Department, and farmers who intend using anfo should make themselves conversant with the regulations concerning its use.

Manufacture of ammonium nitrate-oil explosive

1. (*a*) Anfo shall mean a mixture of ammonium nitrate and oil.

   (*b*) The ammonium nitrate shall be of type suitable for the manufacture of anfo explosive and shall retain, without loss, 6 per cent of the oil specified in (*c*) (i).

   (*c*) (i) The oil shall be an oil derived from petroleum and shall have a flash point in excess of 150° F. (Abel) and less than 200° F. (Pensky Martin closed cup). Automotive diesel fuel is the most suitable.

When using multiple blasts and instantaneous fuse, the fuses are taped together to form the series.

Taping the detonator to the fuse line. Any tape will do. The instantaneous fuse causes fuse, primer and anfo to explode simultaneously.

(ii) The oil shall be stored at a distance of not less than 50 feet from the location of the mixing operation.

2. No person shall mix or cause to be mixed anfo unless the mixing operation is covered by a permit issued by the Explosives Department.

Applications for a permit shall be made and all relevant details submitted to the Superintendent of Explosives, Explosives Department, 82 Pitt Street, Sydney.

3. Manufacture of anfo shall only be carried out by the holder of a permit, in an approved place.

(*a*) The manufacture of anfo shall take place as near as practicable to the site where it is to be used.

Primer cartridge of gelignite with instantaneous fuse laced through it. This is sufficient to explode the gelignite when the detonator is exploded anywhere along a length of this fuse.

(*b*) The anfo shall contain not less than 4 per cent nor more than 8 per cent, by weight, of oil.

(*c*) The ammonium nitrate and oil shall be uniformly incorporated.

(*d*) The mixing shall be carried out in an approved plastic container, an approved plastic lined steel mixer or other approved device.

(*e*) Where a machine is used for mixing, the design should avoid the possibility of frictional heating, compaction and confinement. Bearings and gears shall be protected against entry or accumulation of ammonium nitrate dust.

(*f*) The mixer, containers and utensils shall be cleared at the end of each day's mixing.

(*g*) The use of wooden, copper alloy or zinc-coated containers or mixing devices is prohibited.

(*h*) The manufacture shall take place only under the direct supervision and in the presence of the licensee or a competent person, appointed in writing by the licensee named on the permit.

(*i*) A small quantity of paint or dye may be added to the oil before mixing; no other additives shall be used.

The object of the above regulations is to ensure that there will be no accumulation of ammonium nitrate impregnated with carbonaceous material. The hazard of a build-up of an unsuspected mass of explosive is obvious and should be avoided at all costs. If it is suspected that by some mischance a stock of ammonium nitrate has been contaminated with any carbonaceous material it is desirable that it be destroyed by dissolving in water.

Workers' compensation

Before farm workers using explosives are covered by workers' compensation, the insurance company must be told that explosives are to be used.

On some workers' compensation policy application forms provision is made for stating whether or not explosives are to be used. In such cases, if it has been stated that explosives will be used, this is all the advice that the insurance company requires.

If there is any doubt about the terms of your policy, the insurance company concerned should be contacted before explosives are used. ●

Potato Growers Must Be Licensed

People growing potatoes on more than an acre of land must have a current potato grower's licence, warns the Department of Agriculture's Division of Plant Industry.

The licence costs £1.

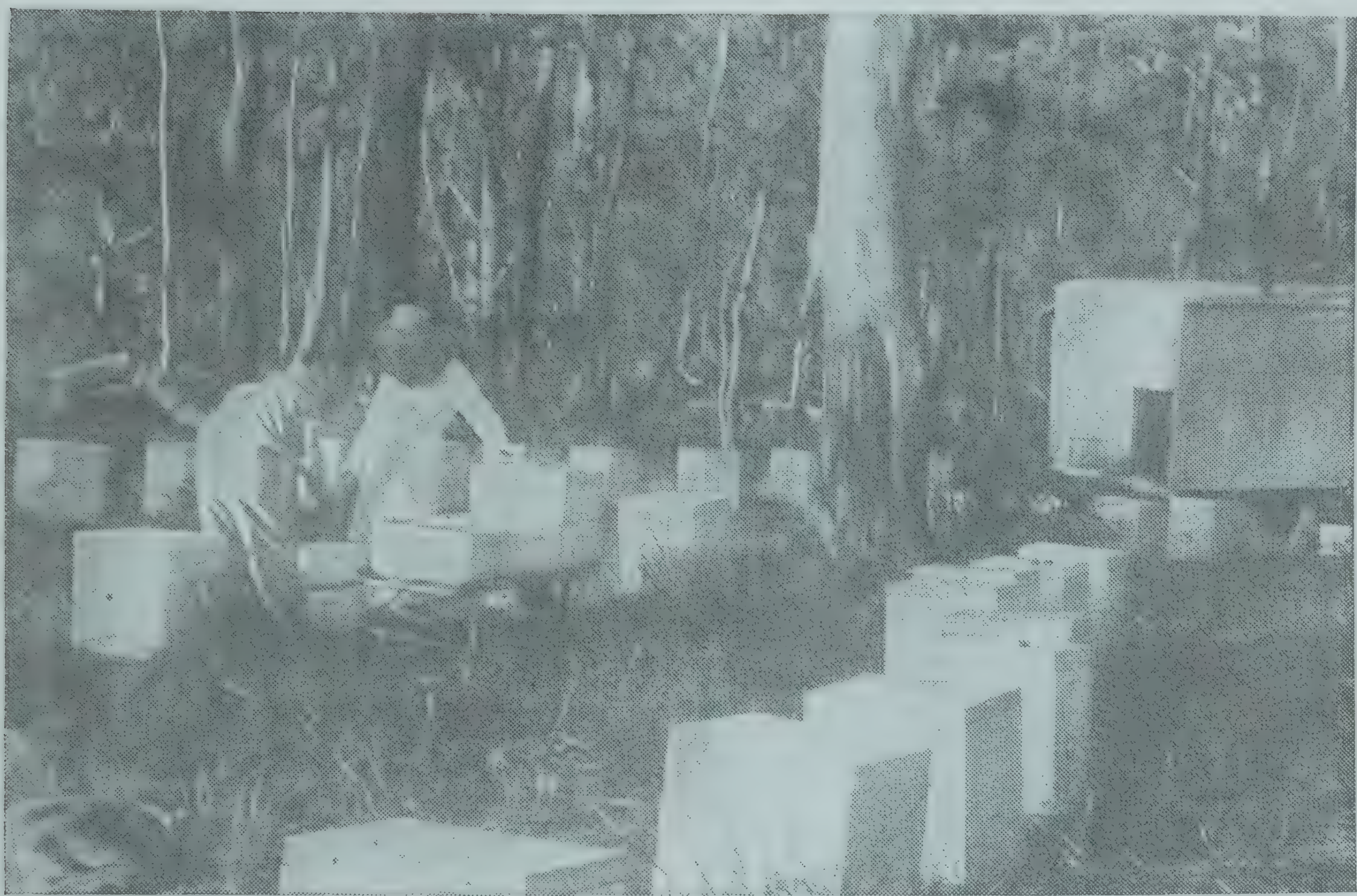
Failure to obtain a licence renders a grower liable to a fine of up to £100, under the Potato Growers Licensing Act of 1940. A licence is valid for a year from the date of issue.

It must be renewed if the grower continues to use an area or areas of more than an acre for commercial potato production.

Application forms for licences can be obtained from the Department of Agriculture, Box 36, G.P.O., Sydney.

OVERSEAS MARKETS FOR AUSTRALIAN HONEY

R. E. COOKE-YARBOROUGH



"Robbing" the hives. A typical apiary forest scene. The honey will be extracted from the comb on the spot—in the mobile extracting van seen in the background.

FROM A FEW tentative, unpromising shipments in the 1880's, Australia has developed her honey exports into the third largest in the world. Currently, some 20,000,000 lb.—half our total crop and a sixth of world marketings—is sold overseas each year. Exports go to 30 countries and earn over £1,300,000 in foreign exchange

The Author: Mr. R. E. Cooke-Yarborough, Economics Research Officer, Farrer Place, Sydney.

Most sales to Europe

European countries have always been the largest buyers of Australian honey. Until the late 1940's practically all went to the United Kingdom. But other markets were developed as well in the post-war years. By 1950, Western Germany and the Netherlands were each taking upwards of 1,000,000 lb. annually.

Exports to Germany in particular grew quickly. In 1954-5, 1957-8 and again in 1961-2 it was the largest buyer. By 1955-6, when Denmark also became an important market, the United Kingdom's share had fallen to less than a half.

The accompanying graph shows the quantities taken each year from 1950 to 1963 by the United Kingdom, Western Germany, the Netherlands and Denmark. Among them, these four countries account for 90 per cent of our total exports. In 1962-3, for instance, they took 25,200,000 lb. of the total exports of 26,800,000 lb.

The quantity imported by the whole of Europe is actually slightly higher, for Italy

Graph showing amounts of Australian honey taken each year from 1950 to 1963 by the United Kingdom, Western Germany, the Netherlands and Denmark.

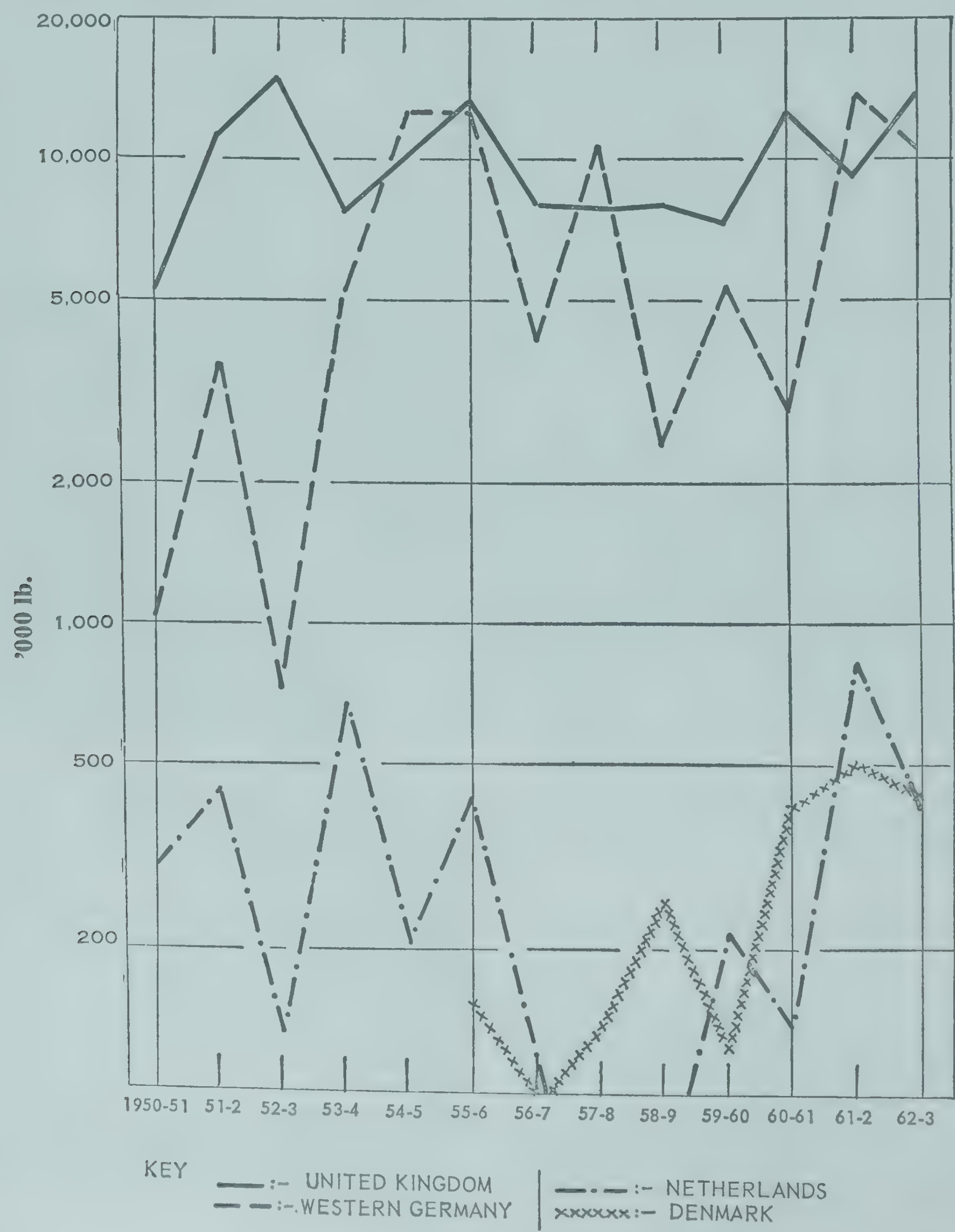


Table 1. Australia's share of imports by certain countries in 1959

Country	Total quantity imported	Imports from Australia: Quantity	Imports from Australia: Percentage of total
	'000 lb.	'000 lb.	Per cent
U.K.	14,277	7,840	54·9
Denmark ..	1,675	249	14·9
W. Germany ..	70,942	2,530	3·6
Italy	2,492	67	2·7
Netherlands ..	5,055	78	1·5
Ceylon	17	6	35·3
Aden	94	27	28·7
Syria	10	2	20·0
Malaya ..	232	37	18·8
Lebanon ..	232	39	16·8

and Belgium are regular but smaller buyers. Each year, Italy takes between 80,000 and 100,000 lb., and Belgium upwards of 50,000 lb.

Although European countries are important markets from Australia's viewpoint, only the United Kingdom depends on us for a large part of its imports. As table 1 shows, we supplied 55 per cent of the United Kingdom's imports in 1959 but only 15 per cent of Denmark's and less than 2 per cent of the Netherlands' imports. By comparison, Middle Eastern and Asian countries depended to a much greater extent (though not as much as the U.K) on Australia for their honey supplies.

Growing outlets in Asia

Since 1960 Australia has been actively expanding markets in South-east Asia. The main one is in Japan, where exports have increased from none in 1958-9 to 55,000 lb. in 1960-61 and to over 1,000,000 lb. in 1963-4 (table 2). Sharply increased exports have also been made to a number of other countries.

Table 2. Australian exports to selected Asian countries, 1960-61 to 1963-4

Country	1960-61	1961-2	1962-3	1963-4
	Pounds Weight			
Japan ..	55,072	37,374	331,104	1,037,226
Ceylon ..	4,202	72	16,860	30,927
Hong Kong	2,576	126,562	217,562	124,659
Fiji ..	906	540	4,610	6,096
Malaya	55,172	68,777	78,797	77,096

Japan has become the third largest market for Australian honey, and Asian countries now collectively take nearly ten per cent of our exports, compared with only one to two per cent during the 1950's. Many of them have begun to rely on Australia for a large part of their honey imports. Japan, for instance, gets half its

Most honey for export is packed in 44-gal. steel drums.

imports—equal to ten per cent of its annual consumption—from us.

This is an important development. Strict grading regulations, import restrictions and competition from other honey exporting countries have severely limited the prospects of larger marketings in Europe and the Middle East. Yet a strong export trade is essential for continued growth of honey production in Australia.

The prospects for increased exports to Asian countries appear good. Higher living standards have caused a demand for honey that already exceeds local production in most of the region. Present supplies there, even with imports, provide less than a fifth of a pound of honey per person each year, compared with about one pound per year in Europe and two to three pounds per year in North America, New Zealand and Australia. ●

Much honey, especially candied honey, is packed in plastic containers holding 1 lb.

Fines for Possession of Protected Plants

Illegal possession of protected wild flowers and native plants is a punishable offence and offenders are liable to a fine of up to £50.

Christmas bells, flannel flowers and bottle brush are flowering at this time of the year, and must not be picked illegally.

The only persons permitted to sell protected wild flowers and native plants are those who grow them on their own properties under licence.

The public is earnestly requested to assist the government to stamp out the illegal sale of wild flowers, by purchasing only those tagged with the grower's name, address and licence number.

The police have been asked to increase their work in bushland areas to prevent the destruction of native flora. Many honorary rangers have been appointed to help enforce the provisions of the Wild Flowers and Native Plants Protection Act. ●

Identify Those Dry Ewes*

D. S. DOUGLASS

A SIMPLE AND PRACTICAL METHOD of assessing the lambing performance of ewes has been adapted for commercial flocks. It involves inspection of ewes as they are put through the race at musters for lamb marking. It allows classification of the flock into those ewes that have lambed and those that have not. Only a few doubtful ewes will need to be turned up for a closer look.

Easily recognisable indicators show whether a ewe has lambed and also if she is still suckling a lamb. The body condition of the ewe and the state of the udder and teats are the best guides, but staining at the back of the udder, soundness of the wool fibre, the belly wool and the type of milk that can be expressed from the teats, may also provide useful evidence.

The efficiency of this method of determining lambing performance has been demonstrated on research stations where accurate records need to be kept for other purposes. Under these conditions, a record sheet is used to note the result of the examination of the ewe against her ear tag number in respect to each feature.

This system can also be effective on a commercial property. The more detailed the records, the more value they are, especially when continued from year to year. If full recording is not desired by a property owner, the inspection can still be carried out and the ewes drafted into three groups—lambed, lambed and lost, and dry.

*Although the observations recorded in this article were of Merino sheep, the principles involved apply to all breeds.

The full, resilient udder of the ewe suckling a a lamb is easy to detect.

The value of examining ewes for lambing performance was demonstrated on a central west grazing property. The owner was seriously concerned at low marking percentages

The Author: Mr. D. S. Douglass, Livestock Officer (Sheep and Wool), Department of Agriculture, Wentworth.

The ewe suckling a lamb has clean teats.

The ewe that has lambed, but lost her lamb, has a quite hard udder, but it is not flat.

of just over 60 per cent. When the ewes were examined through the race a further 25 per cent were seen to have carried a lamb to full term, making a total of 87 per cent that had lambed. This was accepted as satisfactory fertility for both ewes and rams.

Previously the owner had felt that low fertility was responsible for the low marking percentages and had been prepared to spend money on fertility tests and new rams. This survey saved unnecessary expenditure on new sires. It also pointed to a need for a change in managerial policy—particularly a change from autumn to spring lambing.

Inspection of ewes

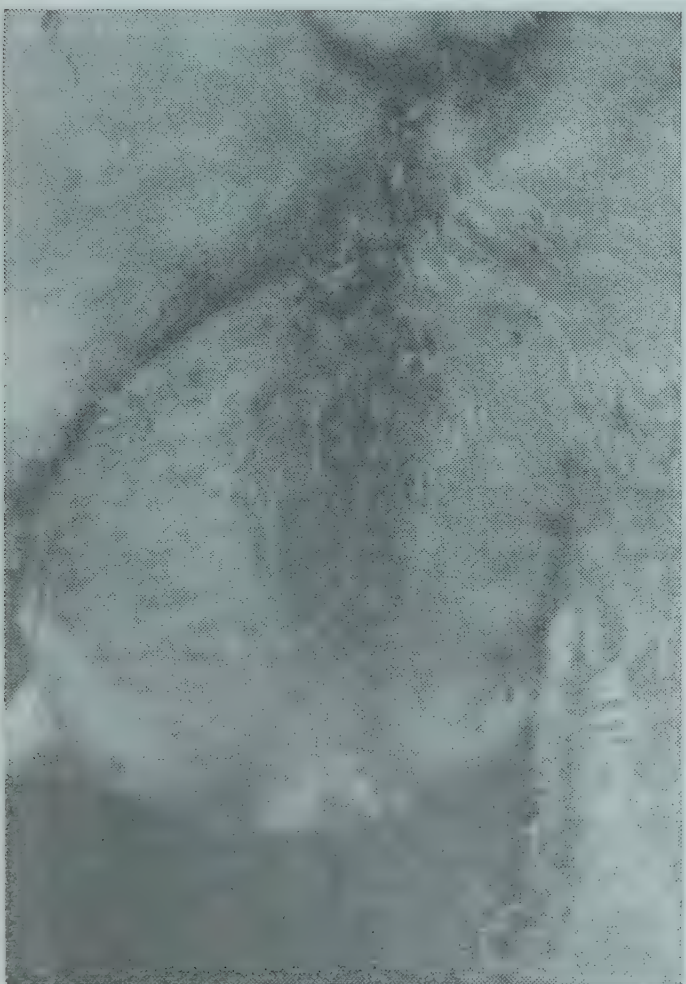
During inspection, ewes are examined for up to six indicators. In some cases one of the indicators will suffice to class a ewe as suckling or dry. In others the combined evidence of several is needed.

Body condition

Dry ewes are invariably very fat while lactating ewes range from store to fat condition.

Considerable variation in body condition is seen in ewes that have lost their lambs at

The dry ewe has had no milk to swell the udder, which is quite flat. However, the large teats, from a previous lambing, are evident.



Dried blood above and on the udder is a good sign that a ewe has lambed. However, if there is no blood, this does not mean that she hasn't lambed.

birth. Where lamb loss follows a prolonged and difficult birth, the ewe often loses condition. However, the ewe losing a lamb after an easy birth rapidly puts on condition and on superficial inspection may be confused with a dry one.

Udder and teats

A lactating ewe has a full udder, resilient to touch. Teats are soft and pliable and clean from suckling, and the clean area may extend on to the udder and the base of the teat.

The teats of a ewe that has lost a lamb are stiff and dirty and the udder is firm and doughy to handle. The groove between the two halves of the udder is quite distinct.

A flat udder and thin, dirty teats are characteristic signs of a dry ewe.

A ewe that has never had a lamb has infantile teats and no udder development.

Examination of udder and teats, used alone, can give a false impression if ewes have been grazing on predominantly clover pastures, where the oestrogen content is high. Milk can be expressed from the teats

of dry and even virgin ewes under these conditions.

Udder staining

A blood-stained crust on the back of the udder is a certain sign of the ewe having lambed. However, the stain does not always last long and it is difficult to see on dark-tipped wool. A ewe without a stain may have lambed.

Fleece tenderness

Particularly when feed conditions are not good, quite a number of lambed ewes have a tenderness in the wool fibre corresponding to the time of lambing. Such tenderness is very rare in fleeces of dry ewes.

Belly wool

A long dense growth of belly wool is normal on dry ewes. In addition, excellent wool coverage is often seen on their faces and points. A ewe with a light or poor belly will usually have lambed.

Milk secretion

Should there still be some doubt whether a ewe has lambed, it is advisable to turn her up and have a further look at the udder. Milk flow can be checked too. Normal milk with quite a good flow can be expressed from the ewe being sucked. A wide variation will be seen in the colour and consistency of milk taken from ewes that have lost lambs. Consistency ranges from the normal milk through cream—custard—cheese, and can finish as a thin, straw-coloured fluid. With most dry ewes a small amount of honey-like secretion can be squeezed from the teats. This flow may be clear or amber-coloured.

Conclusion

Low marking percentages are a financial loss to the grazier. Fewer sheep are available for selection of breeding stock and the number of surplus sheep for sale is limited.

The Merino is not a breed of low fertility; markings exceed 100 per cent in many flocks. The Merino is grazed under very rigorous conditions in many parts of the State and this contributes to a belief that their fertility is low.

As the Merino is quite a fertile animal, markings below 70 per cent in the safer areas should be viewed with concern. If markings are low from an autumn lambing flock a change to spring lambing may solve much of the problem. If low markings are obtained from spring lambing a review of the management policy of the property is needed.

Lamb marking figures as a guide to fertility are totally unreliable. They give no indication as to the number of wet ewes, nor will the figure give any idea of the reasons for low lamb numbers. Inspection of ewes as described in this article gives a reliable record of lambing performance.

The simple record of number of ewes wet, lambed and lost, and dry presented to the veterinarian or advisory officer will help him to define the likely cause of poor marking percentages.

ACKNOWLEDGEMENTS

This article was based on a paper "Recording the Lambing Performance of Ewes under Field Conditions," by R. B. Dun, published in the *Australian Journal of Experimental Agriculture and Animal Husbandry*, **3**: 10; August 1963; 228-31.

Improving Canning Peach Varieties

M C STANNARD

SOME CURRENT INVESTIGATIONS AT YANCO AGRICULTURAL RESEARCH STATION

Canning peaches under irrigation

NEW AND BETTER VARIETIES of canning peaches will probably be made available to fruit growers within the next few years.

Breeding of new fruit varieties has been found necessary in all major fruit growing centres of the world. The Murrumbidgee Irrigation Areas (M.I.A.), though of relatively recent development, are no exception.

The Author: Mr. M. C. Stannard, Fruit Officer (Research), Agricultural Research Station, Yanco.

Most of the fruits canned in New South Wales are grown on the M.I.A. Of these fruits, the canning peach is the major crop, followed by apricots, pears, and others of minor importance. Canning peach plantings in the M.I.A. in June 1962 totalled almost 4,500 acres, or 96 per cent of the New South Wales total.

To obtain better varieties, a continuous variety improvement programme is being conducted at Yanco Agricultural Research Station.

Why do we need other varieties?

It is important in fruit growing to make use of new varieties which have some horticultural advantage. Heavier crop production, higher quality, and adaptability to particular conditions are the usual criteria. In canning peach production, various fruit characteristics are required and, in addition, the correct spread of maturity to ensure continuity of supplies to the processing firms.

The M.I.A.'s most satisfactory peach is the variety Golden Queen, which has been widely grown for many years. Consistent cropping, together with high quality and richly coloured fruits, have made it popular with growers and processors alike. However, the ripening period of this one variety covers only a small proportion of the canning season, with resulting over-supply at the peak period, while for two-thirds of the season, peach deliveries are much lower. This tendency is shown in the accompanying graph in which the peak receivals for 1963 represent mainly Golden Queens.

Therefore, other varieties which are comparable in quality but which mature in January, February and early April are needed. The programme at Yanco aims to supply these varieties.

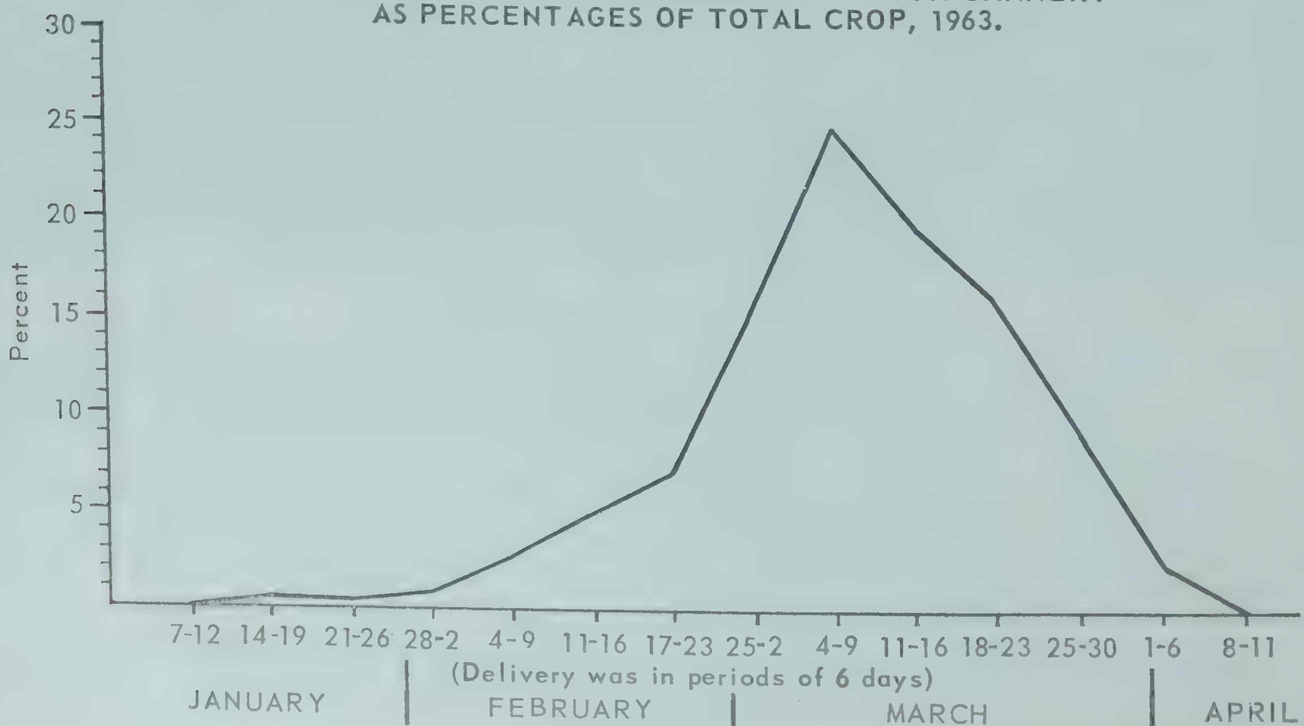
Ways of obtaining new varieties

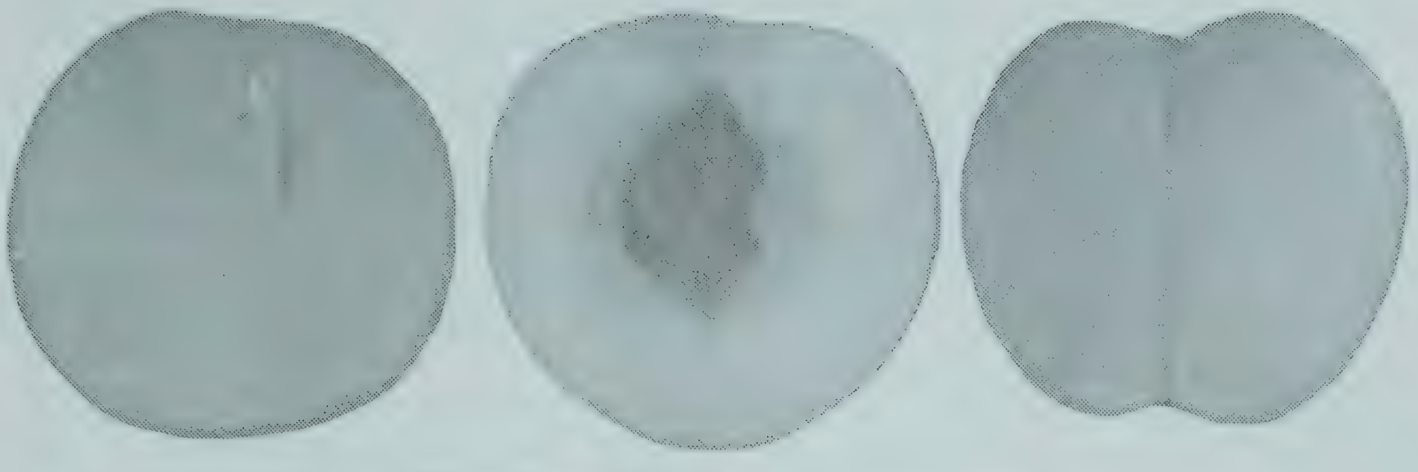
New varieties may be obtained from chance seedlings growing in the locality, from controlled seedling selection, controlled cross-pollination of different varieties, or by introduction—from other districts, other states, and overseas. Bud-sport mutations in commercial plantings also provide a source of new varieties; these vary usually in one characteristic only, for instance earliness or lateness of maturity. They are frequently evident as small or large branches in an otherwise standard tree.

The programme of research work at Yanco employs all the above methods.

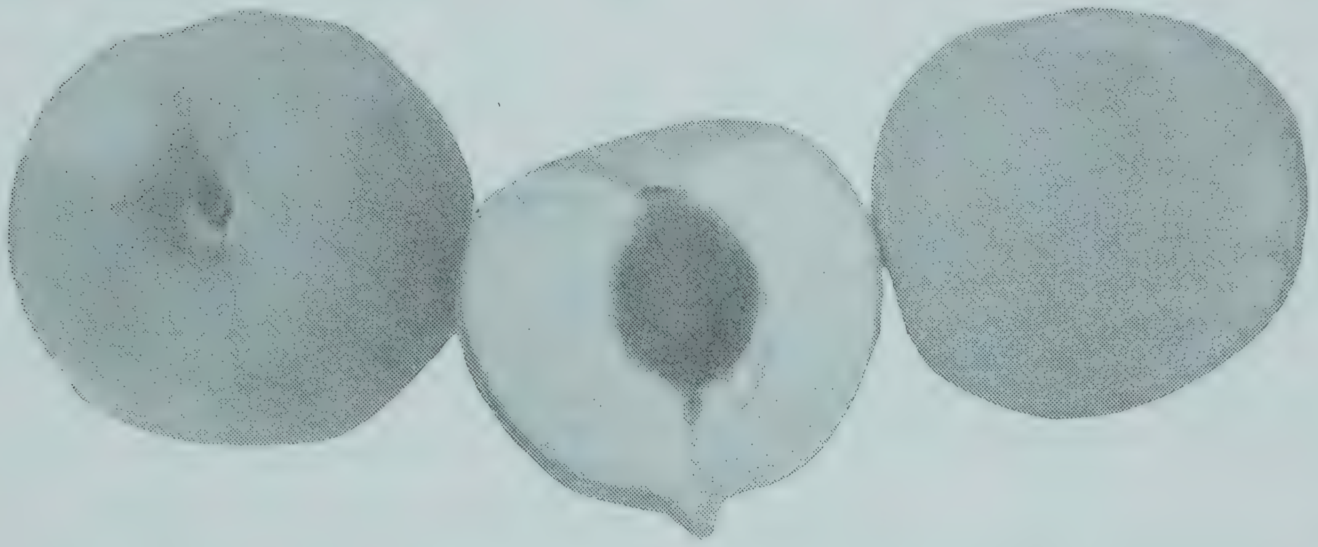
The original selection of a new type is the prelude to lengthy field testing in observation blocks, canning peach variety trials, and testing in district plots. It is

WEEKLY RECEIVALS OF PEACHES AT LEETON CANNERY
AS PERCENTAGES OF TOTAL CROP, 1963.





Golden Queen, widely grown for many years



Shasta, a new variety being tested

only after these that new varieties may be named and recommended to growers.

Desirable qualities

Of the many characteristics necessary for a good canned product, the most important are: the ability to withstand transport; good shape and size; small pit or stone situated centrally; absence of large flange or prominent pit tip; good rich golden to orange colour; absence of green in the shoulder; absence of red colour in the pit cavity, and good flavour and texture.

For the grower, a good variety should bear consistently from year to year, not be prone to excessive immature drop or fruit splitting, hang well when ripe, and produce a high proportion of canning sized fruit. Susceptibility to limb breakage is another factor to avoid. Resistance to diseases and pest damage could also be factors of major importance.

With all these, and other factors in mind, the aim of the breeding programme centres mainly on producing varieties maturing earlier than Golden Queen while at the same time exhibiting high colour. However, any types that are as good as any recommended variety, but having additionally one or more beneficial characteristics are also useful additions to the range. To these ends some progress has been made at Yanco.

Currently recommended varieties

In past years the industry has relied largely on Phillips Cling, Golden Queen and Pullars Cling. New introductions in the last decade or so have meant the replacement of Phillips Cling because it matures so close to the Golden Queen period and produces poor crops. Pullars also is no longer recommended, mainly on the grounds of red centre and poor flesh colour. Other late varieties are preferred.

The present varieties recommended are Youngs Cling, which matures in early January but which suffers from sizing difficulties, heavy immature drop and bruising; Gaume, maturing in mid-February; Stanford, ripening in late February; Boyce, a Transvaal type maturing a week or so before Golden Queen, the main variety, followed by Wight and Windra in late March and early April. These two latter show Transvaal seedling characteristics, are heavy producers of well distributed fruit, highly coloured with good flavour, but do not attain required size readily.

Only Golden Queen, Boyce, Wight and Windra attain the desired flesh colour, and Boyce being so close to Queens in maturity has only limited scope for planting.

Recent selections and introductions under test

All phases of the variety improvement programme are at present in progress, commencing with controlled cross-pollination every season.

Some recently introduced or selected types already producing crops and showing promise, are described.

Recommendations for the planting of new varieties have in the past been evolved by the Department of Agriculture in conference with production and processing sides of the industry. The varieties described here are relatively new to the local scene, and are not yet ready for release.

Early maturing varieties

Youngs x Golden Queen Y55-2 resulted from a controlled cross and is slightly earlier than Youngs Cling. This selection is thought to be less easily bruised than Youngs. Although not fully assessed, in some years the fruit hangs very well, and immature drop is not heavy.

The flavour has been described as exotic. It is similar to Youngs in colour, but is flatter in shape with little or no stylar end tip. There is pronounced compression of the suture groove at the shoulder.

Coronado, a California variety, matures up to two weeks before Youngs. Fruit is yellow fleshed with green shoulder tendency. It is characterised by a large fruit tip. This variety has not been fully evaluated.

Fortuna is also from California, maturing a few days later than Coronado and somewhat similar, although the fruit tip is much smaller.

Shasta, another peach from California, matures about the same time as Youngs Cling. It is yellow fleshed with green shoulder tendency and has not been fully tested.

Tatura Sunrise was recently released by the Victorian Department of Agriculture. This type matures a few days after Youngs Cling, and could replace this variety, which suffers from excessive premature drop, sizing problems and does not withstand long distance transport to processors. Sunrise is of Levis x Young parentage, bred at Tatura, and is now incorporated in the Yanco variety trials.

Tudor Seedling is an open pollinated seedling from the variety Tudor (Californian) raised at Yanco; indications of heavy cropping and good hanging ability are offset by variable pit placement and prominent tip. It is free from green shoulders and matures at the end of January. Observations so far are confined to the original seedling.

Goosen peach originated from South Africa but differs in characteristics from the typical Transvaal seedling types in being more upright and less willowy. It has been apparent over several seasons that the maturity range is very long, the peak period ranging from the middle to the end of January. The fruit is very pubescent, heavily tipped and plump, with yellow flesh not as deep as the later South African types. The first crop under field conditions at Yanco seemed promising; however susceptibility to brown rot fungus is one factor to be examined.

Tatura Dawn peach was named and released by the Victorian Department of Agriculture several years ago, being a seedling of the variety Levis raised at Tatura

Horticultural Research Station. Maturity date is similar to Goosen's. The fruit is pleasantly flavoured, pit cavity is tinged with red, and the colour is yellow, similar to Youngs Cling. Further information will be forthcoming from variety trials.

Mid-season varieties

Keimos is one of the more promising of the South African importations. This is one peach of very high colour and it matures mid to late February, some two weeks in advance of Golden Queen. It is an example of the type needed to spread the canning season. This variety is now included in a field trial and characteristics which could restrict its value will be fully assessed within the next few years. Growers' plots are also commencing to bear.

Boyce x Elberta Y57-16 is a controlled cross from Yanco, the outstanding characteristic of this type is its earliness combined with excellent colour. The original seedling tree has produced fruit maturing at the same time as Keimos. They were less pubescent and of better shape. Trees have been propagated for further investigation.

Yanco Queen, although not yet recommended, has been named as it is a budsport mutation from a Yanco Golden Queen tree. General characteristics are very similar to Golden Queen but it is usually two weeks earlier. There is a possibility of reversion to normal Golden Queen maturity as successive propagations are made. For this reason, a most exhaustive test period is necessary before general release, otherwise instances may arise where plantings contain trees ripening at various times.

Late season varieties

Late season varieties usually mature in March or early April.

Kakamas is one of the most popular peaches in South Africa, where it was selected from the Transvaal seedling types and would be equivalent to our Golden Queen in importance. It is noted for its high colour and other desirable canning qualities. The value of this variety in the M.I.A. will not be known for some time as assessment has only recently begun. The maturity period approximates that of Boyce, which also exhibits many fine characteristics and has already established popularity in these areas.

Tatura Sunset, was released by the Victorian Department of Agriculture several years ago, but local details about it are limited. Of Pullar x Golden Queen parentage this variety matures about mid March or later.

Maluti is another South African variety of Transvaal seedling type. Maluti matures in late March, sets numerous fruit evenly along laterals and would require fairly severe thinning. Flesh colour is equal to Wight or Windra and, provided sizing problems are overcome, could be successful as a late season peach.

Tokane could have applied to it all the potentialities ascribed to Maluti. The main difference is its maturity period (a week to ten days later). The first information available from trial plantings appears to be promising, although these and many other late varieties being tested are inclined to suffer losses from brown rot. This variety also requires heavy thinning.

A number of other late varieties have many desirable characteristics and may eventually prove worthy of recommendation. However, for these late maturing types the urgency of breeding and selection is not so great at the present time. Throughout the M.I.A. Pullars Cling still comprises a considerable proportion of the plantings and, being popular with many growers, is likely to retain its importance for some years yet.

Future prospects

Suitable varieties for the canning peach industry on the M.I.A. will probably originate from a number of sources. Some varieties from overseas, at present in quarantine, are thought to be promising. At various times interesting samples which may warrant further examination are obtained from district blocks.

For breeding work at Yanco there are some three hundred varieties, crosses, or seedlings which may be found useful, perhaps not always as straight varieties but as parents of varieties. ●

Livestock Health Notes

J. S. Healey

LICKS FOR SHEEP UNNECESSARY

From time to time letters are received by this Department from graziers who have either purchased or are contemplating the purchase of mineral lick for sheep. Often the graziers concerned have been talked into making the purchases by travelling salesmen. The letters seek the views of the Department on the advisability of providing mineral supplements for sheep.

Except in isolated areas where there are specific problems, this Department does not recommend the provision of minerals licks for sheep. Not that sheep do not need minerals—they certainly do. However, the mineral content of pastures, even during dry periods, meets the normal requirements of sheep.

Even where sheep need some additional mineral, as a counter to a special problem, it is often better to give it to them in a form other than licks. For example, cobalt for the prevention of phalaris staggers is best given in the form of cobalt bullets. One disadvantage of licks is the extreme variability of consumption from sheep to sheep. There are always some which avoid the lick altogether.

Another aspect of the matter worth mentioning is that in some cases the administration of minerals can be harmful. In the limited part of New South Wales where there is copper deficiency, a copper supplement is desirable. But where pastures already have a high copper content, as they do in certain areas, extra copper may cause many deaths.

Where doubt exists as to the mineral requirements of stock, it is wise to discuss the matter with the veterinary inspector for the district.

AUTUMN MAY BRING FOWL POX

The late summer to early autumn is a time of the year when fowl pox can be troublesome in some areas. This disease is spread by mosquitoes and so is most prevalent during periods of greatest mosquito activity. In the days when chickens were hatched in the spring it was not necessary to vaccinate birds against fowl pox before they reached the age of twelve weeks. This was in fact the normal age of vaccination. Now however, with continuous hatching, it has become necessary to vaccinate day old chickens hatched in the summer and autumn.

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For this purpose the poultry raiser has the choice of two types of vaccine. These are pigeon pox vaccine and fowl pox vaccine. The former is completely safe but produces only partial immunity lasting one to two months. Fowl pox vaccine on the other hand results in a strong and longer lasting immunity, but may cause losses. However, this risk is greatly reduced if certain precautions are taken. Of these, the most important are to ensure that at the time of vaccination the chickens are healthy, and to feed an antibiotic supplement such as terramycin or aureomycin. This supplement is fed at a high level (50 to 100 grammes per ton of feed). It is made available to the chickens for eight to ten days, commencing on the eighth day after vaccination.

Instead of including the antibiotic in the feed, a soluble form of the antibiotic can be added to the drinking water. This form of administration has the advantage that the drug is taken by chickens whose appetite may be impaired. Some poultry raisers have successfully combined antibiotic in the drinking water with furazolidone in the feed.

For full protection against fowl pox it is advisable for birds vaccinated as day olds to be revaccinated before coming on to lay. Vaccination of course confers no benefit on birds already affected with fowl pox. Once an outbreak has started, it is usually too late for vaccination to be of benefit.

SWINE POX

While on the subject of pox diseases spread by mosquitoes, mention might be made of swine pox. This is not a true pox disease but has been given the name because it is caused by a virus and is characterised by pox-like lesions. Mosquitoes are not the only spreaders of swine pox. Lice can also do the job quite effectively.

When mosquitoes spread the infection, the lesions occur mainly on the ears, back, sides and the tail—in other words on the most exposed parts. Lesions appear as numerous dark scabs varying in size from that of a sixpence to a florin. In lice-transmitted swine pox, the affected areas are mainly the lower abdominal region and the insides of the legs. Mortality from swine pox can be high, particularly in young pigs.

Control of an outbreak spread by lice is relatively simple. Merely eliminate the lice. Any one of the organic phosphorus insecticide sprays is sufficient for this purpose. When the disease is mosquito-transmitted, control is much more difficult.

Under the provisions of the Stock Diseases Act, outbreaks of swine pox are required to be notified to a veterinary inspector.

BE CAREFUL WITH POISONS

The value of stock lost annually by poisoning would undoubtedly run into many thousands of pounds in New South Wales alone. An unfortunate aspect to these occurrences is that in most cases they could be avoided by that extra degree of care that so often makes the difference between safety and accident.

The District Veterinary Officer at Armidale recently investigated four cases of poisoning. To each one, the foregoing remarks appear to apply.

In one case, a tin of phosphorus crow poison spilled on to the floor of a shed. The material then seeped under the door to an area occupied by pigs. The result was the death of two pigs.

In another case a number of cattle died after gaining access to a pressure tank containing arsenic used at a sawmill for the treatment of timber. Further cattle deaths resulted when a mob was turned into a paddock where arsenic had been used to poison trees. Finally, to complete the story, one cow was lost from the effects of poison acquired in an area where an old shed had been dismantled. Arsenic had been stored in the shed.

A feature of many poisons, including arsenic, is that they possess an attraction for stock. This accounts for the eagerness with which poisons are often eaten by stock. ●

The Agricultural Research Institute at Wagga Wagga

HERON AND FALCON WHEATS and Cooba oats—all recent products of the Department's cereal breeding programme—illustrate in a very tangible way the work of the Agricultural Research Institute, which was established at Wagga Wagga in the southern wheat belt in 1953.

Heron was released in 1958. Because of its wide adaptability and a capacity to yield so well, it has quickly risen to occupy the top acreage position for New South Wales. Falcon, released in 1960, has also proved itself throughout the central and southern wheat areas. It was produced following a call by the wheat industry for a high quality bread wheat that would yield well. As such it marks an important stage in the implementation of the Department's breeding policy. Cooba oats, produced by Institute officers at Temora Agricultural Research Station, has been widely acclaimed as a most valuable dual purpose variety.

The main building at the Institute

Regional research

The Institute had its origins during the early post World War II years, a period which brought many dramatic changes in crop and pasture husbandry in southern New South Wales. It was envisaged as a step towards placing the research activities of the Department on a regional basis. The decentralisation of both the research and extension services of the Department enables the results of current research to be brought more rapidly and directly to the man on the land.

Of great importance was the location of the laboratories of the Institute adjacent to a large city (population of Wagga Wagga 23,000). Thus situated, research scientists and their families have access to educational facilities and social amenities in the city. In return, the research officers are able to contribute in quite a significant way to the life and cultural development of the city itself.

Facilities for field investigations are provided on the farm of Wagga Agricultural College, at Temora and Condobolin Research Stations, and on selected private properties throughout the region. Quite recently the scope of activities has been extended to the new Coleambally irrigation area. Here, a programme has been commenced to develop semi-dwarf wheat varieties specifically for irrigation conditions.

Administration

The Institute is financed from State Government Funds, supplemented more recently by grants from the Wheat Industry Research Committee of New South Wales, the Federal Wheat Industry Research Council and the Wool Research Trust Fund.

Research programmes are periodically reviewed by a Technical Advisory Committee comprising senior officers of the Department with co-opted representatives of the C.S.I.R.O. A further advisory committee enables adequate liaison to be maintained with the wheat growing, milling and bread manufacturing industries.

Research programmes

Since 1950 the acreage of sown pastures in the south west slopes and Riverina has increased more than threefold to a figure now approximating 4,000,000 acres. Such pastures are based on subterranean clover, which has been so enthusiastically adopted by Australians as the key to a new agriculture which is now emerging. Perhaps nowhere else in the world has any single species of plant contributed as much to the fertility of the soils of a region. Most of the Institute's work bears directly on problems arising from the changed pattern of land use.

Top dressing of pastures with superphosphate and a lowered intensity of cropping have increased soil nitrogen levels and improved soil structure. In a general way we know a little of how the higher fertility levels affect yields and the quality of subsequent wheat crops. However, new practices for both livestock and crop production will need to be evolved. Recent seasons have made it clear that a real danger exists if fertility is allowed to build up to levels higher than the expected rainfall can sustain. If this happens, haying-off occurs, wheat yields are reduced and poor grain samples may result. Research work on this problem has been intensified following the allocation of additional funds by wheat growers.

The newly enriched soils favour the growth of grasses in pastures, and barley grass may become a dominant species, bringing with it a variety of problems. It is well known as a host plant to take-all, one of the most troublesome diseases of wheat following clover ley. The development of improved pasture grasses is currently being undertaken by a group of C.S.I.R.O. workers at the Institute.

The hitherto poor reputation that the southern wheat areas have had with respect to wheat quality must now be completely reviewed. The close day by day association of wheat breeders with cereal chemists has

led to significant improvement of varieties. Such varieties must be designed specifically for ley land conditions—they must be strong strawed, disease resistant and capable of giving the maximum quality response at the higher protein levels which characterise wheat crops grown on ley cropped land.

Improved pastures have also highlighted the need for the development of new methods of pasture and stock management. This forms the subject of new research financed by wool funds.

The future

Through the establishment of regional research facilities supported financially by governments and growers alike, there is every reason to expect a continual flow of results bearing on current and future problems of primary industry. It is the hope of those associated with the Institute's work that the next ten years will justify the regional research point of view and set a pattern for similar institutes elsewhere in Australia. ●

Keep Calves Growing

Dairy farmers should always aim to keep calves growing, for a check of even a few weeks often affects their subsequent growth.

Calves that are growing well are more resistant to checks and diseases.

It is usually the poorer doers that are troubled by checks and diseases, which further break down their condition.

Although it does not take much experience to tell whether calves are doing well or badly, a farmer needs more experience to tell if his calves are growing at a satisfactory rate.

The following table shows growth targets for Jersey calf weights, at fortnightly intervals from birth.

Age (Weeks)	Live-weight (lb.)
Birth	56
2	70
4	86
6	102
8	119
10	136
12	157
14	178
16	200
18	220
20	242
22	262
24	280
26	300

This table is based on measurements and weighings of more than 2,000 Jersey calves at the New Zealand Department of Agriculture Research Station, Ruakura.

Not as much is known about other breeds, but weights for corresponding ages should be increased about 25 per cent for Ayrshires, about 30 per cent for Australian Illawarra Shorthorns, and about 40 per cent for Friesians.

Add these amounts to the weights in the table to get an approximate guide to growth rates for these breeds. ●

Oat Variety Recommendations for 1965

C. Walkden-Brown and R. W. Fitzsimmons

Interest in the production of oats, particularly for grazing, continues to increase in New South Wales, in conformity with expanding sheep and cattle populations. It is aided in no small degree by the availability of varieties better suited to grazing and subsequent recovery for grain than some of the older types.

The number of sheep in New South Wales at 31 March 1964 was approximately 71,764,000, the highest number ever recorded and an increase of 1,743,000 compared with the previous season. Cattle numbers at 31 March 1964 (4,789,000) were also a record, an increase of 220,000 compared with the previous season.

In 1963-4, oats were grown on almost 21,000 New South Wales holdings, of which number 9,300 grew the crop on areas of 20 acres or more.

In 1963 the area sown to oats for all purposes was 1,516,000 acres compared with 1,343,000 in 1962 and the record acreage of 1,627,000 acres in 1958. The area from which grain was harvested was 794,000 acres (52 per cent of the total), and 64,000 acres (4 per cent) was cut for hay. The remainder of the area, 658,000 acres (44 per cent of the total) was used for green feed only. Grain production for the year was 19,812,000 bushels valued at about £8,222,000—compared with the record total of 27,638,000 bushels in 1958.

The figures for grazing are for those crops grazed out completely. The area for grain includes crops grazed once or more and then allowed to recover for grain.

Figures for oat production and yield over the past ten years are shown in table 1.

Advantages of oats

On mixed farms, the value of oats is now widely recognised. They provide nutritious grazing for stock during winter and, if

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Table 1. Oats—areas, grain production and grain yield per acre in N.S.W. for ten-year period 1954-63 (Source—Commonwealth Bureau of Census and Statistics).

Year	Total Area acs. x 1,000	Area for grain acs. x 1,000	Area for hay acs. x 1,000	Area for green fodder acs. x 1,000	Grain Production bush x 1,000	Grain Yield bush/acre
1954	1,248	657	101	490	7,667	11·7
1955	1,363	902	102	359	16,537	18·3
1956	766	420	46	300	6,274	14·9
1957	1,222	715	106	401	3,944	5·5
1958	1,627	1,130	117	380	27,638	24·5
1959	1,096	567	59	470	11,125	19·6
1960	1,570	917	98	555	21,556	23·5
1961	1,357	713	65	579	13,225	18·5
1962	1,343	708	65	570	16,035	22·6
1963	1,516	794	64	658	19,812	25·0
Av. 1954-1963	1,311	752·3	82·3	476·2	14,381·3	19·1

properly managed will recover to give good yields of grain which can be economically produced and easily stored.

Use of oats for grazing when pastures are growing slowly allows the grazing of pastures to be deferred until early spring. It is then that adequate pasturage is of special value to spring-lambing ewes. Oat varieties that provide early grazing—in April, May and early June—are very important for autumn-lambing ewes. The next demand period, for the spring-lambing ewes, starts in late July and August. Oat varieties that produce the greatest bulk of grazing late in the season are of most value to satisfy this demand.

Oats fit very well into a pasture improvement programme. It is often advisable to sow oats for grazing before putting an area down to improved pasture, as a better seed-bed results for the pasture sowing. Oats can be used as a renovating crop on old pasture land too. They will also supplement the grazing from pasture areas by producing bulky growth when pastures are growing slowly. In addition, grazing oats are a useful crop after a period of pasture improvement; they use the nitrogen built up in the soil more effectively than grain crops.

Cereal crops grown for grain only are prone to hay off under these conditions. In some districts, grazing oats are used as a cover crop in establishing improved pastures.

Sown during late summer or early autumn, oats provide valuable supplementary grazing during winter.

In districts of low rainfall, where sowing improved pasture is something of a gamble, oats, in rotation with wheat, play a major role in the crop rotation. In all districts oats are important in the rotation to combat root rot diseases built up by wheat, barley, and barley grasses.

Oats can be roughed in on stubble or old pasture land instead of a well-prepared seed-bed as demanded by wheat. And, if the work is planned correctly and the right variety chosen, production of oats interferes little with the sowing and harvesting of wheat crops.

Fodder reserve

Fodder conserved as grain is one of the best forms of insurance against drought and the accompanying need to reduce stocking levels.

As a grain fodder reserve, there is no more economical crop to grow and store than oats. And there are fewer feeding problems with oats than with other grains. Oats can be stored in bulk with less risk of weevil infestation and deterioration than with any other grain.

With the improvements achieved in varieties, oats can now be grown under a wide range of soil and climatic conditions—extending from coastal districts to drier and hotter areas on the plains.

Milling oats

About 20 per cent of the oat grain crop is used for oatmeal and rolled oats. Only the best quality grain is accepted by milling firms, who mainly prefer the variety Belar because of its plumpness, good flavour, and low husk percentage.

However, Belar is no longer recommended for general purpose sowings in the main oat grain growing areas of central and southern New South Wales. This is because of its poor performance both in grazing and grain production. It is now recommended there for milling purposes only. Because of its relatively poor performance also in northern New South Wales, it may soon be replaced there by a more suitable dual purpose variety. Seed of this dual purpose variety is now being increased in anticipation of possible recommendation later.

Other recommended varieties which may be accepted for milling, when grown under conditions favourable to a good grain finish, are Algerian, Ballidu, Cooba and Avon.

Choose the right variety

Although suitable varieties are available to meet varying requirements and climatic conditions, there is ample scope for plant breeders to effect further improvements. Disease resistance, with particular reference to rusts, and better grazing yields are the most important breeding objectives for the northern region and the coastal districts. In the southern division better grazing and recovery characteristics, improved grain and straw quality, and high grain yields, are the main objectives of the breeding programme.

A farmer will obtain best results from oats when he selects the most suitable varieties for his special requirements. Suitability of any variety depends on the purpose for which the crop is grown. Oats, being versatile, can be used for grazing, grazing and grain, hay, grain for stock feed, or grain for milling. To assist in selection, plant breeders and district agronomists of the Department of Agriculture review the performance of varieties each year. This review is based on results of carefully conducted experiments and general field observations. Variety recommendations are made from the information thus obtained.

Some newer varieties show distinct advantages over older varieties, and farmers should take these into consideration when making their choice. The varieties Fulmark, Acacia, Avon, Orient, Klein 69B, Cooba, and the new Algerian strain, deserve special consideration.

Variety recommendations are now based on agricultural regions, and for this purpose the State is divided into nine zones, as shown on the map on page 35.

Table 2.—Percentage of total sowings of the 10 leading oat varieties

Variety	1954-5	1957-8	1958-9	1959-60	1961-2	1963-4
Belar ..	52·8	54·8	45·6	40·5	32·8	22·5
Avon ..	..	..	..	..	4·7	14·7
Algerian ..	26·5	26·8	22·4	23·5	20·2	14·2
Fulmark ..	..	..	0·5	1·3	5·9	7·8
Fulghum ..	6·2	6·4	5·2	5·7	7·0	7·4
Cooba ..	..	..	..	..	..	4·6
Dale ..	1·8	2·4	4·9	6·1	5·2	3·6
Orient ..	1·7	1·5	2·3	2·7	3·1	2·7
Ballidu ..	1·8	1·1	3·1	2·7	3·1	2·2
Acacia ..	0·8	1·0	2·4	2·9	2·7	1·9

Variety statistics

Oat variety statistics for the seasons 1954-5, 1957-8, 1958-9, 1959-60, 1961-2, and 1963-4 show that the popularity of varieties is changing. Belar, the most popular variety in the State for many years, has fallen in acreage from 52.8 per cent to 22.5 per cent of the total area under oats.

Algerian, which has been grown for almost a hundred years, is now in third place. Avon is showing the fastest rise in popularity. Other varieties increasing in acreage are Fulmark and Cooba. Details of variety censuses are shown in table 2.

Sow at correct time

Time of sowing is of the utmost importance. If the crop is to provide winter grazing, it should be sown early in autumn. This will permit good root development and early establishment before the onset of cold weather. In tableland districts, sowing should commence about late January or during February. Spring sowings, in August and September, can be made on the cool parts of the northern and southern tablelands. In the hot districts with low rainfall, March is a good time to sow. Too early sowing in these districts has little to recommend it, and is attended by the risk of partial crop failure.

Where oats are to be sown for hay or grain only, early sowing is not recommended. When oats are sown in early autumn and not grazed, they are very subject to cold damage and lodging. May is the best month for sowing for hay or grain.

If oats are used for dual purposes the grazing management will depend largely on the time of sowing or when the season breaks. Early sowing grazing oats (normally mid-February to early April) should be grazed heavily. Later sown crops should be lightly grazed when sufficient pasture is available, thus enabling a better recovery for grain.

Varieties are classified as early, mid-season, and late. Early-maturing varieties are quick growing and should be sown late, while late-maturing varieties, which have a longer growing period should be sown early. The approximate maturity of oat varieties, from the earliest maturing (Ballidu) to the latest maturing (Garry), is:

Early maturing: Ballidu, Orient.

Mid-season: Cooba, Fulghum, Burke, Fulmark, Dale, Belar, Avon.

Late: Algerian, Klein 69B, Lampton, Acacia, Garry.

Rate of seeding

In average seasons, oats sown early stool freely, and less seed is required than for late sowing. Varieties vary considerably in grain size and in their capacity to stool. For example, Burke is a very small-grained variety and flows more freely through the drill than larger-grained varieties such as Belar and Algerian.

For prime hay production, a fine straw is desirable. One method of achieving this is to increase the sowing rate. Heavy, fertile soils encourage stooling, however, and under these conditions a light seeding is satisfactory.

When using a drill, sowing rates range from 1 to 2 bushels an acre. In the dry districts and on fertile soils, the recommended rate is 40 to 50 lb. an acre. In districts of good rainfall this may be increased to 60 lb. and for tableland districts 70 to 80 lb. Oats intended for grazing are sown at 40 to 60 lb., the lower rate in the low rainfall districts, and the higher for the slopes and tablelands. In some coastal districts, where machinery is not always available for sowing, the seed is broadcast at, usually, from 2 to 2½ bushels per acre.

Under conditions of adequate rainfall or irrigation, rates of up to 4 bushels of seed per acre may be used on prepared land, where the crop is primarily intended for grazing—provided adequate nitrogen fertilizer is supplied, additional to superphosphate.

Use of fertilizers

Oats, like wheat, respond to superphosphate in districts where it is usual to apply fertilizer.

When clover is sown with oats, application of 1 cwt. of superphosphate an acre is recommended. In northern districts, apart

from on some of the light soil types, fertilizer is not usually necessary. For the dry parts of the central and south-western districts, from 42 lb. to 56 lb. superphosphate an acre is sufficient. For other inland districts, from 56 lb. to 112 lb. an acre is recommended.

On the coast, heavier applications are necessary, particularly if the superphosphate has to be broadcast, when 1 cwt. to 1½ cwt. an acre is applied.

Preliminary investigations suggest that under conditions of adequate rainfall or irrigation, on prepared land, stocking rates can be greatly increased by application of up to 60 lb. of nitrogen per acre (equivalent to 130 lb. of urea or 290 lb. of sulphate of ammonia), accompanied by a higher superphosphate dressing.

Where anhydrous ammonia cannot be applied before sowing, to supply all the nitrogen needed, 20 lb. nitrogen should be applied with the seed, and the remainder after the first grazing. Seeding rates should be increased to up to 4 bushels per acre.

Seed treatment

Organic mercury seed treatments are recommended for the control of oat smut diseases. These treatments also have the advantage of protecting against seed rot and damping-off in the soil. Thus routine use of organic mercury seed treatments on all seed oats is strongly recommended by the Department. They should be used in accordance with the directions on the containers. Of the present recommended varieties, the most susceptible to smut diseases are Algerian, Fulghum, Burke, and Orient.

RECOMMENDATIONS

The Department's recommendations for oat varieties to be sown in the various zones of the State in 1965 have been subdivided into groups for heavy grazing and grain, light grazing and grain, and grain only. In some zones varieties are also recommended for spring sowing or for milling.

Oats required for heavy (prolonged or frequent) grazing should be sown early, i.e., early February to late March, depending on the district and seasonal conditions. Later sown crops can be lightly grazed if needed as they should recover to produce good grain yields. However in both cases varieties should be chosen from the heavy grazing and grain or light grazing and grain lists.

Northern Agricultural Region

(Eastern section: Tamworth (Regional H.Q.), Manilla, Inverell, Tenterfield, Glen Innes, Guyra, Armidale.)

Heavy grazing and grain: Acacia, Klein 69B, Cooba, Fulghum.

Light grazing and grain: Algerian.

Grain: Acacia, Klein 69B, Lampton, Algerian.

Spring sown for grain (Tablelands only): Garry, Lampton.

N.B.—Acacia and Lampton are only suitable for the high areas of the Region.

(Western section: Barraba, Bingara, Gravesend, Warialda, North Star, Yetman, Delungra.)

Heavy grazing and grain: Cooba, Fulghum.

Light grazing and Grain: Belar, Orient.

Grain: Orient, Ballidu, Avon, Belar.

North Western Agricultural Region

(Northern section: Gunnedah (Regional H.Q.), Boggabilla, Garah, Milguy, Moree, Biniguy, Wee Waa, Pilliga, Narrabri, Bellata, Baradine, Boggabri, Mullaley, Quirindi, Spring Ridge, Tambar Springs, Premer.)

Heavy grazing and grain: Cooba, Fulghum.

Light grazing and grain: Avon, Belar, Orient.

Grain: Orient, Ballidu, Avon, Belar.

(Southern section: Coonabarabran, Binnaway, Coolah, Mendooran, Dunedoo, Merriwa, Cassilis.)

Heavy grazing and grain: Acacia, Klein 69B, Cooba, Fulghum.

Light grazing and grain: Algerian.

Grain: Acacia, Klein 69B, Avon, Algerian.

Western Agricultural Region

(Eastern section: Orange (Regional H.Q.), Bathurst, Wellington, Birriwa, Gulgong, Mudgee, Yeoval, Molong, Manildra, Cudal, Eugowra, Blayney.)

Heavy grazing and grain: Acacia, Cooba, Fulghum.

Light grazing and grain: Algerian, Cooba.

Grain: Acacia, Lampton, Algerian, Fulmark, Avon.

N.B.—Acacia and Lampton are only suitable for the high areas of the Region.

(Western section: Coonamble, Gular, Armatree, Tooraweenah, Gilgandra, Collie, Eumungerie, Dubbo, Trangie, Narromine, Tomingley.)

Heavy grazing and grain: Cooba, Fulghum.

Light grazing and grain: Belar, Burke, Orient.

Grain: Orient, Avon, Fulmark, Burke.

Mid Western Agricultural Region

(Eastern section: Cowra (Regional H.Q.). Canowindra, Woodstock, Greenethorpe, Koorawatha, Young, Boorowa.)

Heavy grazing and grain: Cooba, Acacia (high areas only).

Light grazing and grain: Algerian, Burke, Cooba.

Grain: Algerian, Avon, Fulmark.

(Western section: Tottenham, Albert, Tullamore, Trundle, Bogan Gate, Condobolin, Tullibigeal, Ungarie, Lake Cargelligo, Wyalong, Quandialla, Bribbaree, Grenfell, Parkes, Peak Hill, Forbes.)

Heavy grazing and grain: Cooba.

Light grazing and grain: Burke, Fulmark, Orient.

Grain: Avon, Orient, Burke, Fulmark.

Mid Coast and Hunter Agricultural Region

For western portion, see North Western Agricultural Region; for coastal portion, see Central Coast.

Southern Agricultural Region and South Coast and Tablelands Agricultural Region

(Eastern section: Stockinbingal, Cootamundra, Murrumburrah, Gundagai, Tumut, Batlow, Tumbarumba, Binda, Crookwell, Goulburn, Gunning, Yass, Canberra, Cooma, Dalgety, Bombala.)

Heavy grazing and grain: Cooba, Acacia.

Light grazing and grain: Algerian, Cooba.

Grain: Acacia, Lampton, Fulmark, Avon.

Spring sown for grain (tablelands only): Garry, Lampton.

N.B.—Acacia and Lampton are suitable only for the high areas of the Region.

(Western section: Wagga (Regional H.Q.), Temora, Ariah Park, Ardlethan, Ganmain, Coolamon, Junee, Lockhart, The Rock, Henty, Holbrook, Albury.)

Heavy grazing and grain: Cooba.

Light grazing and grain: Algerian, Avon, Orient, Cooba.

Grain: Avon, Fulmark, Orient.

Milling purposes only: Belar.

South Western Agricultural Region

(Leeton (Regional H.Q.), Hillston, Merriwagga, Rankin's Springs, Barellan, Griffith, Carrathool, Grong Grong, Narrandera, Urana, Oakland, Rand, Corowa, Tocumwal, Berrigan, Jerilderie, Deniliquin, Mathoura, Moama, Moulamein, Balranald.)

Heavy grazing and grain: Cooba.

Light grazing and grain: Orient, Avon, Cooba.

Grain: Orient, Avon, Fulmark.

Irrigated areas (in all Regions)

Heavy grazing and grain: Cooba, Acacia.

Light grazing and grain: Avon, Cooba, Acacia.

Grain: Acacia, Algerian, Avon.

North Coast

Early grazing: Ballidu.

Late grazing: Klein 69B, Algerian, Cooba.

Grazing and hay: Algerian, Cooba.

Central and South Coasts

Early grazing: Ballidu, Fulghum.

Late grazing: Klein 69B, Algerian, Cooba.

Grazing and hay: Algerian, Cooba.

NOTES ON VARIETIES

Acacia

Acacia was bred at Glen Innes Agricultural Research Station from the cross (Victoria x Richland) x (Algerian x Fulghum) by S. L. Macindoe and selected by J. G. Carroll. Acacia is a long-season oat, maturing about a week later than Algerian. It has brown, plump grain and short, strong straw. In early sowings on the tablelands and the Murrumbidgee Irrigation Areas it has given excellent results for grazing and grain production.

Acacia has a high resistance to smut, but is susceptible to stem and leaf rusts. It is prone to shattering.

Algerian

Seed of a new, improved strain of Algerian became available in 1958. This new strain is similar in most respects to the previous strain widely grown in this State, except for its more erect growth in early stages, better tillering, wider leaves, and better grazing at all stages (especially early). It is a late maturing variety. The straw is tall and fine, but weak, and produces excellent quality hay. The grain is light brown with two distinct weak awns, and is suitable for milling.

The original strain of Algerian grown in this State was introduced from Algeria. Both strains of Algerian are susceptible to smut.

Avon

Avon was recently released by the Western Australian Department of Agriculture. It is a selection from the cross Ballidu x M59 (Mulga x Laggan) made at Wongan Hills by J. Reany.

It is mid-season maturing, ripening a little later than Belar. It produces a very good bulk of fodder for early grazing, but recovery for later grazing is poor. Grown solely for grain it has produced outstanding yields when sown early or mid-season. It is for grain production that Avon is primarily recommended.

The grain is pale cream in colour, very large, and plump. Although the hull percentage is high and bushel weight generally low, the grain is suitable for milling except in seasons when "haying off" occurs. The yellow, rather coarse, straw is short and of good strength. The grain is firmly held and there is little shattering, even in strong winds. Avon is the most resistant to shattering of all currently grown varieties. It is resistant to smut, but is susceptible to leaf and stem rusts. In some seasons it is affected by stem break at maturity, making harvesting difficult.

Ballidu

Ballidu is a Western Australian variety selected from the cross Mulga x Burt's Early. It is early maturing—a week or two earlier than Belar. Ballidu produces a vigorous early growth, but does not recover well after grazing, and straw quality is weak.

Ballidu is suitable for grain and hay production, and for early green fodder on the coast. It is well suited for late sowings when a short-season type is required. The grain, which has a coarse awn and is liable to shattering, is suitable for milling.

Belar

Belar is a New South Wales selection from Sunrise, developed by J. T. Pridham in 1918. It is probably a natural cross between Sunrise and Algerian. It is about a week earlier than Algerian, which it resembles in its adaptation to a wide area of the State as a general-purpose oat.

Belar has weak straw, though slightly stronger than Algerian, and produces excellent hay.

The grain is cream to pale brown, long, plump, and of excellent milling quality. Belar enjoyed great popularity as a grain oat because it was superior to other varieties of similar maturity. However, in recent years this position has altered. In southern areas Belar has been replaced in recommendations by higher yielding grain varieties

such as Fulmark, and Avon, unless required specifically for milling.

Belar has a very low hull percentage but not as low as Cooba. As a grazing variety, it is inferior to most recommended varieties, and has a poor recovery for grazing and grain.

Belar is susceptible to stem and leaf rusts, but has some resistance to smut.

Over the last three decades this variety has been the most popular in the State but its popularity is rapidly declining.

Burke

Burke is an early mid-season variety, with medium tall strong straw. Its main characteristics are its moderate resistance to stem rust and its ability to hold grain for long periods after maturity. As a grazing variety, Burke produces a good bulk of early green feed, but its recovery is only fair. The grain is small and not suitable for milling, but the husk is thin and the groat percentage higher than in most other commercial oat varieties.

Burke is susceptible to smut and to leaf rust.

This variety was originally received from South Australia as a selection from Kherson, obtained from the United States of America, where it was introduced from southern Russia in 1896.

Cooba

The promising new dual-purpose oat Cooba was bred by J. G. Carroll at Glen Innes Agricultural Research Station and selected by F. Mengersen at Temora Agricultural Research Station. It was developed from the cross (Victoria-Richland x Algerian x Fulghum) x (Victoria-Richland x Sunrise x Fulghum). Cooba is an early mid-season maturing variety of about the same maturity as Fulghum. It appears to have wide adaptability for grazing and grain and seems especially suited as a dual-purpose oat for southern New South Wales and coastal districts.

Cooba produces more green fodder than Fulghum and has shown a slightly higher recovery for grain after heavy grazing. It proved to be highly resistant to trampling and other injuries caused by stock.

It has a rather slow early growth but an outstanding recovery, both for grazing and grain, after the first grazing. Thus it is best suited for continuous grazing and for grazing and grain. If it is grazed in the early stages the straw strength is satisfactory. The straw is of medium height, and fine.

For grain purposes, Cooba yields well in late sowings and in districts where a short-season type is required. It has the lowest husk percentage of all recommended oat varieties.

Cooba has some resistance to smut and leaf rust but is susceptible to stem rust.

Fulghum

Fulghum is an early mid-season maturing variety that has been pre-eminent until recently as a grazing oat. In the last few years it has been equalled or surpassed in grazing and grain yields by Cooba. Its yields of hay and grain are satisfactory, but the quality of the hay is not as good as that of some other varieties. The grain is of medium size, plump, brown, but unsuitable for milling.

As Fulghum is highly susceptible to smut and has very weak straw, it is not recommended for grain production. It is also susceptible to leaf and stem rusts.

Fulghum was originally introduced from the United States of America, where it is recorded as a single plant selection made about 1897 in a field of Red Rustproof oats. The variety now in use here is the result of further selections made in New South Wales.

Fulmark

The promising new variety Fulmark was bred by T. E. Kitamura, of the New South Wales Department of Agriculture, and selected by R. H. Martin, at Temora Agricultural Research Station. It was selected from the cross (Fulghum x Fulghum x Gidgee) x Markton.

The Agricultural Regions of New South Wales for Cereal Variety Recommendations

NOTES: Dotted line represents approximate western limit of economic wheat production for grain.
Separate recommendations are made for irrigated areas.

REGIONS
1. North Coast
2. Mid Coast and Hunter
3. South Coast and Tablelands
4. Northern
5. North Western
6. Western
7. Mid Western
8. Southern
9. South Western

Fulmark is a mid-season maturing variety (a few days earlier than Belar in southern areas but later than Belar in central areas). It appears to have wide adaptability and seems especially suitable as a grain oat for the Southern Division, generally out-yielding Belar by up to 20 per cent.

Fulmark provides a good early bulk of green feed, comparable in amount to that provided by Belar, and after grazing it recovers a little better than Belar. Also, in its recovery for grain after grazing, Fulmark seems to be slightly superior to Belar.

The straw is fine and strong, but rather short for hay. The grain is long and plump and of creamy colour. Unfortunately, Fulmark is not suited for milling as it has a hard, brittle husk.

Fulmark is moderately resistant to shattering and smut, but is susceptible to leaf and stem rusts.

Garry

The variety Garry was developed at Winnipeg, Canada. It has given high grain yields in late districts, especially when sown

in spring. It was selected from the cross (Victory x Victoria) x (Hijira x Banner). It has strong straw, smut resistance, and a good quality grain, though rather small. Its stem rust resistance is the best among all the varieties available at present. It is not suited to grazing.

Garry is recommended only for spring sowing for grain on the northern and southern tablelands.

Klein 69B

Klein 69B is an introduction from Argentina. It is late maturing, usually ripening up a week later than Algerian. The straw is of medium height, fine, and inclined to lodge.

The grain is light brown with a thin husk and of medium size, with fine awns.

Klein produces high yields of hay or grain in the good rainfall areas, usually outyielding Algerian. Late in the season in coastal districts it produces very high yields of green fodder, with good recovery.

It has moderate smut resistance, is susceptible to stem rust, and is moderately resistant to the common strains of crown rust.

Klein 69B is recommended for late grazing on the coast and for grazing and grain in the Eastern Section of the Northern Agricultural Region.

Lampton

Lampton was bred by crossing an unnamed strain of Abruzzes x Victory with Reid.

It is later maturing than Algerian. Its use is restricted to the tableland areas, where it produces heavy yields of grain and hay. It is not suitable for grazing.

The grain is slightly smaller than that of Algerian, is brown, shiny, and usually plump and of good quality.

Lampton is suitable for spring sowing on the northern tablelands, and the coldest parts of the southern tablelands. It is slightly resistant to stem rust and is much more resistant to smut than White Tartarian.

Orient

Orient is a Victorian variety selected at Mallee Research Station, Victoria, from the cross Palestine x Dawn.

It is early maturing, with short and fine but weak straw and good stooling ability. Orient is suitable for early grazing, but its recovery is inferior to some later maturing varieties. Because of its short straw, Orient does not yield well for hay. The grain is plump, of good quality, brown with a strong, black awn. The grain is unsuitable for milling. It is very susceptible to smut and susceptible to leaf and stem rusts.

This variety is recommended for late sowings in districts where a short-season type is required. It has performed very well in such areas in recent years.

ACKNOWLEDGEMENTS

Assistance in compiling certain sections of this report was given by officers of the Division of Science Services and especially by Dr. F. Mengersen, oat breeder at Temora Agricultural Research Station. ●

Avoid Overheated Engines

If you have not already checked your engine cooling systems you should do so now, advises the Department of Agriculture's Agricultural Engineer, Mr. J. G. Drever.

Clogging of radiator or water-jacket passages can seriously restrict the cooling system and reduce engine efficiency.

Water passages are mostly blocked by rust, mineral deposits from bore water, or mud from farm dams.

Clean rainwater should always be used; certain types of water hasten corrosion.

The incorrect use of anti-freeze is also a common cause of trouble.

Most anti-freeze compounds contain a form of ethylene glycol that forms a corrosive acid with air and heat.

Anti-freeze solution should not be left in during the warm months.

Rust and corrosion start in the most vulnerable areas—the core plugs, corners in waterways, pump impellers, and radiator cores.

As the engine gets older, pieces of corroded metal break off and obstruct water passages, causing further overheating.

Drain

The cooling system should be drained and cleaned out with a flushing compound and liberal hosing.

A reverse flushing should also be carried out periodically.

The flow of air through the radiator is most important and the narrow spaces around the radiator tubes should be kept clear.

If these spaces are blocked with dust, inserts or trash, the flow of air is restricted.

The dirt can be easily removed by a pressurised jet of water; the water should be squirted from the engine side of the radiator.

Fan

The flow of air through the radiator may be inadequate if the fan is not being driven fast enough.

Slipping of the belt may cause this slow speed and will wear the belt rapidly.

Tension of the fan belt on most tractors should allow for one half inch to three-quarter inch deflection half-way between the two belt pulleys.

This tension should be adjusted carefully by moving the generator toward or away from the cylinder block.

An over-tight fan belt will cause excessive wear on the bearings of the generator or water pump.

Thermostat

It is difficult to check the thermostat without removing it, but this is relatively simple and worthwhile.

The thermostat can be tested by placing it in water and heating the water.

At about 160 degrees F. the bellows should expand and open the flap.

The temperature at which the flap should open is marked on many thermostats.

Hoses

Radiator hoses and hose clips should be critically inspected.

Hoses should be replaced if there is any sign of sponginess or deterioration.

The water pump should be removed and checked for wear—particularly wear of the spindle bearings.

If radiator shutters or a blind is fitted to the tractor, it should work freely.

When renewing water in the cooling system, fill, then run the engine for 10 to 15 minutes to warm it up and watch for any leaks; then check the water level.

Leaks

Leaking hose joints may need tightening of the hose clips.

Leaks from the radiator core may need more drastic measures.

Some proprietary sealing compounds are quite efficient for stopping leaks; if they fail the radiator should be checked by an expert. ●

New Plant Diseases

One of the interesting observations among the new plant diseases was of downy mildew on sorghum. Leaves of affected plants are rough, thickened and twisted.

BIOLOGY BRANCH

DURING THE YEAR seventy-three new plant diseases were recorded in New South Wales. Twenty-five of these were new host records of *Meloidogyne* spp., the root knot nematodes. This reflects the increasing attention being given to plant parasitic nematodes in the Biology Branch. These new records of *Meloidogyne* spp. will be the subject of a separate publication and are not listed below.

Onion yellow dwarf virus Melhus *et al.* 1929 was recorded for the first time in N.S.W. on onions at Griffith. Transmission tests to healthy onions gave positive results. In the field and fodder crops, several new diseases of safflower were recorded. These

included rust (*Puccinia carthami* Cda) which was recorded from both northern and southern districts, leaf spot (*Cercospora* sp. resembling the description of *C. carthami* (H. & P. Sydow) Sund & Ramal. given in Chupp's monograph of the genus *Cercospora*), and root rot (*Phytophthora* sp.). Rust is one of the most important diseases of safflower in the United States and, with the increasing importance of safflower growing in N.S.W., it could become a problem here.

The increased interest in tropical legumes on the north coast of N.S.W. has lead to the recording of several diseases on these plants. Root rots caused by *Macrophomina phaseoli* (Maubl.) Ashby, *Rhizoctonia* sp. and *Sclerotium rolfsii* Sacc. and leaf spots caused by *Ascochyta* sp. and *Cercospora* sp. have been seen on several new leguminous hosts this year. Another interesting record was that of downy mildew (*Sclerospora* sp.) on sorghum (illustration on previous page).

On fruit crops, one of the most interesting new records was a root rot of the grape stock variety Dulot, caused by a species of *Phytophthora*. This disease was first recorded in a vineyard at Orchard Hills. and has subsequently been seen in other coastal areas.

On ornamental plants, leaf rot of carnations, caused by the fungus *Heteropatella valtellinensis* (Trav.) Wollenw. was recorded for the first time in N.S.W. from a commercial planting at Cronulla (see *Agricultural Gazette*, January 1964, p. 783). Another interesting record was the finding of the leaf nematode, *Aphelenchoides fragariae* (Ritzema Bos 1890) Christie 1932 associated with the ink disease of the West Australian kangaroo paw (*Anigozanthos manglesii*).

Aeschynomene americana—Stem rot (*Sclerotinia* sp.), Grafton, J. F. Burdett.

Agaricus bisporus (Lange) Sing. (cultivated mushroom)—Nematodes in compost (*Aphelenchoides composticola* Franklin 1957), Picton, R. McLeod.

Allium cepa L. (onion)—Yellow dwarf (Onion yellow dwarf virus Melhus *et al.* 1929), Griffith, B. J. Ballantyne.

Anigozanthos manglesii (kangaroo paw)—Leaf nematode (*Aphelenchoides fragariae* (Ritzema Bos. 1890) (Christie 1932)), Beecroft, R. McLeod. This nematode was associated with the ink disease of these plants and it may be an important factor in the development of this disease.

Bothriochloa sp. (red grass)—Rust (*Uredo* sp.), Jindera, J. Walker; on the basis of uredospore characters, this rust seems closest to *Puccinia cesatii* Schroet. as defined by Cummins (*Urediniana* **4** : 75-78, 1953).

Brachypodium distachyon (L.) Beauv. (false brome)—Smut (*Ustilago bullata* Berk.), Albury, J. Walker; this smut is commonly seen on *Bromus* spp. in N.S.W. but this is its first record on *Brachypodium* in this State.

Capsella bursa-pastoris (L.) Medic (Shepherd's purse)—Blackleg (*Phoma lingam* (Tode) Desm.), Gundagai, R. J. Conroy.

Capsicum annuum L. (capsicum)—Leaf spot (*Ascochyta* sp. and *Phoma* sp. associated), Tumbi Umbi, R. J Conroy.

Carthamus tinctorius L. (Safflower)—Leaf spot (*Cercospora* sp., similar to *C. carthami* (H. & P. Sydow) Sund. & Ramak. as described in Chupp's monograph of the fungus genus *Cercospora*, p. 127), Richmond, A. M. Smith; root rot (*Phytophthora* sp.), Leeton, A. M. Smith; rust (*Puccinia carthami* Cda. II, III), Yanco, A. M. Smith.

Cucumis sativus L. (cucumber)—Soil rot of fruit (*Rhizoctonia* sp.), Tumbi Umbi, B. J. Ballantyne.

Cucurbita lundelliana Bailey (Peten gourd) —Powdery mildew (*Oidium* sp., similar to conidial *Sphaerotheca fuliginea* (Schlecht.) Poll.), Rydalmere. B. J. Ballantyne.

Danthonia eriantha Lindl. (a wallaby grass) —Inflorescence smut (*Ustilago readeri* Syd.), Orange, J. Walker.

Dianthus caryophyllus cult. var. (carnation) —Leaf rot (*Heteropatella valtellinensis* (Trav.) Wollenw.), Cronulla, J. Walker. This disease caused quite severe leaf damage in a commercial planting.

Dolichos lab-lab L.—Root rot (*Sclerotium rolfsii* Sacc.), Dondingalong, J. F. Burdett.

Dolichos uniflorus Lam.—Leaf spot (*Cercospora* sp.), Taree, A. M. Smith.

Eucalyptus caesea Benth.—Damping-off of seedlings (*Botrytis cinerea* Pers. ex Fr.), Narrabeen, A. M. Smith.

Hibiscus rosa-sinensis cult.—Leaf spot (*Phyllosticta* sp.), Chatswood, J. Walker.

Matthiola incarna (L.) R. Br. (stock)—Crown rot (*Phytophthora* sp.), Casula, A. M. Smith.

Medicago tribuloides Desr. (barrel medic)—Burn (*Leptosphaerulina* sp.), Canberra, A. M. Smith.

Mucuna gigantea DC (velvet bean)—Root rot (*Rhizoctonia* sp. and *Sclerotium rolfsii* Sacc.), Dondingalong and Wingham, J. F. Burdett and A. M. Smith.

Pennisetum clandestinum Hochst. ex Chiov. (kikuyu grass)—Dead patches in turf (possibly *Sclerotinia homoeocarpa* F. T. Bennett), Rosehill, A. M. Smith. The patches in kikuyu were much larger than the small dollar spots seen in other grasses. The identification of this fungus as *Sclerotinia homoeocarpa* is based on the similarity of its cultural characters to those described by Bennett (*Ann. appl. Biol.* **24**: 236-257, 1937) for his fungus. Apothecia have not been seen in N.S.W. Whetzel (*Farlowia* **2** : 436, 1946) considered the fungus described by Bennett to be a species of *Rutstroemia*. In his original work on *S. homoeocarpa*, Bennett studied an isolate of the fungus from Queensland and the N.S.W. fungus is similar to this.

Phaseolus aureus Roxb. (mung bean)—Leaf spot (*Ascochyta phaseolorum* Sacc.), Taree, A. M. Smith; root rot (*Macrophomina phaseoli* (Maubl.) Ashby), Dondingalong, A. M. Smith; leaf spot (*Phyllosticta* sp.), Taree, A. M. Smith; root rot (*Rhizoctonia* sp.), Dondingalong, A. M. Smith.

Pueraria thunbergiana (Sieboed & Zuec.) Benth. (kudzu)—Rust (*Uredo* sp.), Macksville, A. M. Smith.

Salvia sp. (red salvia)—Stem rot (*Sclerotinia sclerotiorum* (Lib.) de Bary), Chatswood, B. J. Ballantyne; no apothecia seen, identification based on sclerotium and cultural characters only.

Senecio vulgaris L. (groundsel)—Powdery mildew (*Oidium* sp.), Ryde, J. Walker; there were no well-developed fibrosin bodies in the conidia of this fungus and the conidial stage resembled that described by Homma (*J. Fac. Agric. Hokkaido Imp. Univ.* **38** : 320, 1937) for the genus *Erysiphe*.

Sisymbrium officinale (L.) Scop. (hedge mustard)—Leaf spot (*Alternaria brassicae* (Berk.) Sacc.), Yetholme, R. J. Conroy; stem rot (*Sclerotinia sclerotiorum* (Lib.) Sacc.), Yetholme, R. J. Conroy; no apothecia seen, identification based on sclerotium and cultural characters.

Solanum tuberosum L. (potato)—Fusarium rot of tubers (*Fusarium redolens* Wr.), Guyra, R. J. Conroy; identified by the Commonwealth Mycological Institute (IMI 101717).

Sorghum sudanense (Piper) Stapf (sudan grass)—Root rot (*Fusarium moniliforme* Sheld. associated), Boggabilla, A. M. Smith; root rot (*Macrophomina phaseoli* (Maubl.) Ashby), Boggabilla, A. M. Smith.

Sorghum vulgare Pers. (sorghum)—Downy mildew (*Sclerospora* sp.), Jerilderie, A. M. Smith.

Strelitzia regina—Black leaf spot (*Cylindrocladium* sp. associated), Epping, J. Dillon; seen in young potted plants in nursery.

Streptocarpus sp.—Leaf nematode (*Aphelenchoides fragariae* (Ritzema Bos, 1890) Christie, 1932), Pennant Hills, R. McLeod.

Trifolium subterraneum L. (subterranean clover)—Leaf spot (*Pseudopeziza trifolii* (Biv.-Bern. ex Fr.) Fckl.), Wantagong, A. M. Smith; This was seen on the variety Howard.

Ulmus parvifolia (a chinese elm)—Little leaf (suspected virus), Pennant Hills, L. R. Fraser.

Vigna sinensis (L.) Endl. ex Hassk. (cowpea)—Leaf spot (*Ascochyta* sp.), Taree, A. M. Smith; leaf, stem and pod spot (*Cladosporium* sp. associated), Taree, A. M. Smith. The possibility that this is *C. vignae* Gardner is being investigated.

Vitis rupestris Scheele (Dulot grape)—Root rot (*Phytophthora* sp.), Orchard Hills, A. M. Smith.

Zea mays L. (maize)—Leaf spot (*Diplodia macrospora* Earle), Mungay Creek, near Kempsey, A. M. Smith. The large spored *Diplodia* on maize in N.S.W. has previously been included under *D. maydis* (Berk.) Sacc.

Interceptions in Plant Quarantine

BIOLOGY BRANCH

A NUMBER OF PLANT SPECIMENS taken from incoming consignments were submitted during the year by the Export and Import Branch. Sclerotia of *Typhula* sp. continued to be found in white clover seed from the United States and ergots of *Claviceps purpurea* were seen in bent grass seed. A rust, *Uredo* sp., was seen on the orchid *Epidendrum stenopetalum* from Panama. On a camellia from Hong Kong was seen a leaf spot of camellia from which a species of *Phyllostictina* was isolated.

The interceptions, listed under the host plant, were:

Agrostis tenuis Sibth. (bent grass).

Claviceps purpurea (Fr.) Tul. Ergot. Sclerotia of this fungus were seen in bent seed from New Zealand and in several samples from U.S.A. This ergot is present on many grasses in N.S.W.

Tilletia decipiens (Pers.) Koern. Bunt. This fungus was found in one sample of seed from the U.S.A. It is not known in N.S.W.

Brachiaria brizantha (Hochst.) Stapf.

Claviceps sulcata Langdon. Ergot. Sclerotia of this fungus were found in one sample of seed from Kenya. This ergot has not been recorded in N.S.W.

Camellia japonica (camellia).

Phyllostictina sp. Leaf spot. This fungus was isolated from leaf spots of camellia plants from Hong Kong.

Carum carvi L. (caraway).

Sclerotinia sclerotiorum (Lib.) de Bary. Sclerotia resembling those of this species were seen in caraway seed from Holland. This is a common fungus in N.S.W. on many hosts but there are no records of it here on caraway.

Catasetum trulla (an orchid).

Colletotrichum sp. On leaf and stalk spots of a plant from Brazil. The disease has not been recorded in N.S.W.

Epidendrum stenopetalum (an orchid).

Uredo sp. Rust. This disease was seen on the undersides of leaves of a plant from Panama. Only the uredospores were seen but these possibly belonged to the genus *Hemileia*. This disease has not been recorded in N.S.W. and the plant was destroyed.

Musa sp. (banana).

Radopholus similis (Cobb 1893) Thorne 1949. This nematode was found in planting material of the variety Lacatan from Hawaii. It is present in soils on the north coast of N.S.W. and causes severe root damage to bananas.

Trifolium repens L. (white clover).

Typhula sp. Sclerotia of this fungus were found again in seed samples from the U.S.A.

FAN COOLS HOT SHEARING SHED

Adapted from an article by B. G. Lucas, M.B., in the Medical Journal of Australia, Vol. 2, 29 Oct. 1960: 689.

"IN ONE SHEARING SHED, in extreme heat, temperatures reached a maximum of, and stayed near, 125°F. Shearing was impossible for any sustained period. The shearers had to rest and cool off after shearing two or three sheep.

"The prevention of heat symptoms and their subsequent economic loss prompted the following experiment. It was suggested that the shearers or, preferably, the whole shed, be cooled by means of a portable fan.

"The ideal fan was found to be a 19-inch inlet type which provided, at 950 r.p.m., an air shift of 6,000 cu.ft. per minute. The necessary power was provided by a stationary 7.5 h.p. petrol engine using approximately half a gallon of petrol per hour. The movable parts—main fan, cooling fan to the motor, and drive belts—were guarded to prevent accidents, as required by safety regulations. The whole unit was compactly mounted on a two-wheel trailer, the gross over-all weight being about 15 cwt. It could thus be towed easily by a light vehicle and moved to suitable vantage points in shade around the shearing shed, or mess huts, for example. By spraying a fine jet of water vapour over the inlet, the component parts of the fan and the delivery air could be cooled. Then, according to requirements, air could be either directed throughout the shed or ducted to each shearing stand, thus cooling each shearer. The rise in humidity by such method is of no importance in the hot, dry west.

"The following facts demonstrated the efficiency of the unit.

"At one shed the outside shade temperature was 108°F., the registration inside the shed was 125°F. An average of only three sheep could be shorn consecutively, the heat then forcing the shearers to rest. The following day, inside readings were again 125°F. After half an hour's running of the fan, the inside temperature had fallen to 86°F. No shearing time was lost, and no shearers were inconvenienced by sweat or other untoward heat symptoms.

"In tests at another shed the outside shade temperature was 108°F., the temperature inside was 110°F. The fan reduced the inside temperature to 68°F. No time was lost, and six men crutched 3,200 sheep on that day. This compares more than favourably with the same shed the previous year, when the outside shade temperature was 103°F., and only 1,740 sheep were crutched by the same shearers.

"The fan has provided a boon to all in the shed (including the hard-working sheep dogs, which often took some coaxing back to work in the hot sun). Working conditions were more pleasant and healthy, without time loss, and both employer and employee benefited. The fan may also find a place in the drying of sheep; wet weather accounts for much time loss and lack of production, at least two days of fine weather being needed for sheep to dry." ●

RESEARCH SECTION

SOIL POTASH

UNTIL RECENT YEARS, potash fertilizers were not needed on most New South Wales soils unless an intensive form of production, like vegetable growing, was practised. As the intensity of land use has increased, with bigger or more frequent crops and more productive pastures, more cases of potash deficiency have occurred. It is probable that potash fertilizers will eventually be needed on many soils if high yields are to be obtained.

An effective soil test for potash is not yet available in New South Wales. Such a test would be more sensitive and more certain than plant symptoms in detecting deficiencies, and quicker than field trials in determining the amount of fertilizer needed.

Different methods of soil analysis for potash give different readings, and no method determines the precise amount of potash available to plants. The problems for the soil chemist are to decide on a suitable method, or combination of methods, of analysis and to determine the relation between the results and plant response. These problems are being studied by I. A. Vimpany at the Chemistry Branch. Chemical procedures for analysis have been tested and compared, and a large scale pot trial is in progress.

Forms of potash

Potash exists in the soil in four forms: water soluble; exchangeable; non-exchangeable but available; and non-exchangeable and unavailable. Exchangeable and water soluble potash can be measured together by leaching a soil sample with a salt solution. All water soluble potash is immediately available to plants but the proportion of the exchangeable form that is available varies to some extent with other characteristics of the soil.

Non-exchangeable but available potash can be determined by extracting the soil sample with an acid. Some methods of extraction give estimates of two types; one readily available to plants, the other not available immediately. The amount of potash present in the soil but not available to plants immediately is a useful measurement because there is a slow change from one form to another.

Mr. Vimpany is using seven soils in the pot trial. They range from soils known to

be low in available potash to soils known to be high in available potash. Japanese millet is used as an indicator crop, and so far four crops have been grown. At the end of each cropping period the plant material is weighed and analysed. The weight is a measure of the plant response to each rate of potash application while the analysis measures the amount of potash that the plant removed from the soil. The soil is analysed after each crop and again after the fertilizer is added ready for the next crop. These analyses allow a comparison between the amount of potash determined by chemical methods and the amount the plant can obtain.

In the trial, water and nutrients other than potash are supplied in sufficient quantities to ensure that potash deficiency is the only factor likely to limit growth. The levels of potash application range from nil to a level above that considered to be the optimum amount.

Field trials

The pot trial will provide basic information that will allow more accurate estimation of the potash status of a soil than has previously been possible. However, field trials will be needed to establish standard levels of potash before chemical tests can be used to recommend rates of potash fertilizer application. Field trials are being started this year in co-operation with research agronomists.

It will be some years before all the results of this long term project are available. When the work with Japanese millet as the indicator plant is completed, a smaller trial with a legume will be undertaken to check response differences. The results already obtained are being used to assist agronomists in interpreting field observations.

CLIMATIC CONTROL OF MATURITY IN WHEAT

INVESTIGATIONS at the Agricultural Research Institute, Wagga Wagga, have recently been focused on the way climatic components of the environment control the development and maturity of wheat varieties. Temperature and the length of the daylight periods during the early stages of the growth of the wheat crop are the chief components of the environment being investigated. A clearer understanding of these factors would help cereal breeders in their improvement programmes.

The outward expression of the plant's response to climatic factors may be readily observed and measured as differences in the time taken to reach the stage of ear emergence. However, the origins of these responses may be detected during the early stages of growth while the plants are quite small—during the first five to six weeks after germination. Dissection of the young plants and examination with a hand lens may reveal the very early stages of development of the ear. At that time it is located almost at ground level and completely enclosed by the young developing leaves. The beginning of ear development marks the onset of the reproductive phase and its timing is quite important.

It is customary to classify the world's wheat varieties as winter or spring types, depending on whether or not the young plants in the rosette stage need to experience a period of cold before forming the young, rudimentary ears. It is now possible for wheat breeders to breed a certain degree of "winterness" into their crossbreds, and in this way it is possible to impart some flexibility to a variety and broaden its adaptability. Breeders anticipate that such wheats will be less liable to damage from stem frosting—a problem quite serious with

many of the less adapted varieties of the past. Varieties with some "winterness" may be seeded over a longer period with safety.

It has recently been shown that, as a group, Australian spring wheats are less sensitive to the seasonal changes in day length than Canadian spring varieties which have been developed for cultivation during the long days of the North American summer. This is quite important in that it helps to explain the basis of early maturity which has long been regarded as a valuable characteristic of Australian varieties.

New research has clarified the mode of inheritance of the "winter" growth habit and of the sensitivity to day length changes. This will now provide the breeder with a greater degree of control in his task of fashioning improved varieties.

POTENTIAL INSECT PESTS OF SUB-TROPICAL LEGUMES

A SURVEY on the north coast is showing that many insects attack sub-tropical pasture legumes. Established plants are less likely to be affected than seedlings because they usually grow prolifically and have strong root systems.

B. M. Braithwaite, the entomologist who is making the survey, considers that the following insects are potentially serious pests of seedling sub-tropical legumes: *Graphognathus leucoloma* (white-fringed weevil); *Agrotis* sp. and *Prodenia litura* (cutworms); *Halticidae* (flea beetles); *Melanagromyza phaseoli* (bean fly); and *Noctuidae* (semiloopers). *Rhopaea magnicornis* (pasture white grub), normally thought of as a pest of grassland, was an unusual pest observed on one seedling stand. Six acres of *Glycine javanica* sown into a clean seed-bed with green panic was completely destroyed by *Rhopaea* larvae severing the tap roots of the young plants.

Amnemus quadrituberculatus (clover root weevil) the most serious pest, caused extensive damage to established *Desmodium uncinatum* and *Glycine javanica* during the dry spring of 1964.

Heliothis spp. (Heliothis caterpillar), and to a lesser extent *Nezara viridula smaragdula* (green vegetable bug) and *Riptortus* sp. (pod-sucking bug), are common pests of seed crops of Siratro, *Desmodium* spp. and *Glycine* sp.

VETCH DISEASES

THE VETCH VARIETY Golden Tares has assumed an important place in the feed-year system being developed for the far north coast, but disease outbreaks have limited production. The outbreaks were most severe in two years with very wet autumn periods—1958 and 1963. In these years the losses were almost total in the majority of stands. In other years the losses from disease have been considerably lower, but occasional bad outbreaks have been reported. Apart from the direct loss to the farmer, these diseases have posed a difficult problem for agronomists who can recommend no real substitute for vetch.

Limited observations by agronomists and plant pathologists in the past have been unsuccessful in defining the problem. Accordingly, the Biology Branch located R. N. Allen, plant pathologist, at Wollongbar

Agricultural Research Station to make a more detailed continuous field study of vetch diseases than had previously been possible.

Although the symptoms of disease overlap to some extent, it became obvious that more than one disease was involved. Two diseases are considered to be of prime importance. These are root rot, and decline. The root rot is primarily a disease of seedlings and young plants, and it affects stand density. Decline may become apparent any time from a month to three months after sowing, and it affects plant vigour.

Current research on vetch diseases is directed at separating and identifying the diseases, finding their relative importance, isolating the causal organisms, and examining the effects of cutural practices. During 1964, Mr. Allen surveyed vetch crops on sixty farms in the Wollongbar area. He found some disease in all crops, although the effect on production was not nearly as great as in 1958 and 1963. There were indications that sowing date and crop rotation are important factors which affect the severity of disease.

The survey and field experiments in 1964 were supported by laboratory and glasshouse studies. These will be continued in 1965 with more detailed field trials to test the possibility of control by cultural practice.

WEED CONTROL IN NEW GRAPE PLANTINGS

THE rather prostrate growth habit of young grape vines before trellising makes them particularly susceptible to weed competition under irrigated conditions.

At Griffith Viticultural Research Station Fruit Research Officer, C. R. Turkington, tested the effects of simazine (4 lb. per acre of 50 per cent active ingredient) and vine hoeing, 0, 4 and 6 times, for weed control in newly planted Cornichon grape vines. An 18-inch strip on both sides of the vine row was treated—weeds in row centres were controlled by normal discing. Treatments commenced on 11 December.

Simazine gave good weed control, but a fortnight after application treated vines showed severe yellowing of the leaves, which ultimately died. Although no deaths occurred the vines were weak at the end of the season. The simazine damage was probably accentuated by a heavy irrigation soon after application which leached it into the vine root zone. The sandy nature of the soil would have assisted leaching.

The average weight of prunings is a measure of growth of vines. In this trial the simazine treatment averaged 680 grams per four vine plot. Where weed control was limited to discing in the centres of the rows, the vines were partially smothered and prunings weighed only 250 grams per plot. The best growth was from hoed plots with 1,300 grams and 1,820 grams of prunings respectively from plots hoed 4 and 6 times.

Further observations will be made this season to determine the long-term effects of the big growth differences obtained.

Cotton Insect Pest Control in the Namoi Region of New South Wales

W. E. WRIGHT*

SUMMARY

Fortnightly applications of DDT-endrin, endosulphan and carbaryl were compared against cotton pests in the Namoi region of New South Wales. In addition, fluctuations in populations of Heliothis *spp. and* Earias huegeli *were observed.*

A heavy infestation of Heliothis *spp. in late January–early February was controlled by both DDT-endrin and endosulphan. Carbaryl was unsatisfactory.*

Untreated plots showed that failure to control Heliothis *spp. resulted in a heavy loss of fruiting forms. These were replaced but the later formed bolls failed to mature owing to the short growing season, giving severe yield reductions.*

Earias huegeli *first appeared in December, but numbers remained insignificant until late February when a build-up began, and a peak was reached in April despite three blanket sprayings with DDT-endrin. The pest status of* Earias *was not determined.*

WHILST A RANGE of damaging insects occur in cotton in New South Wales (Gurney 1923, 1924; Wright and Nikitin 1964), common bollworms, *Heliothis* spp., and the rough bollworm, *Earias huegeli* Rogenh, are the most important. Larvae of these Noctuid moths injure the squares and bolls causing them to fall. In addition, larvae of the rough bollworm may enter the terminal growth of young plants and tunnel within the stem.

Other insects, including cutworms, such as *Agrotis* spp., aphids (*Aphis gossypii* Glov.), thrips (*Thrips tabaci* Lind.) and jassids (*Austroasca* spp.) may damage cotton seedlings. The cotton tip borer (*Crocidosema plebiana* Zell.) sometimes infests crops shortly before flowering and the cotton semi-looper (*Cosmophila erosa* Hübn.) may cause appreciable foliage damage, especially in very wet seasons.

In this State, control measures are mainly directed against *Heliothis* and *Earias* for which DDT-endrin is the standard recommendation. The experiment described in this paper was carried out in the Namoi River district to compare the effectiveness of fortnightly applications of three sprays: DDT-endrin, endosulphan and carbaryl. The choice of chemicals was based upon previous results of experiments against these pests (Passlow 1959, Jones, unpublished reports 1962, Davis *et al.* 1963). The experiment also provided an opportunity to observe fluctuations in the populations of the bollworm species and the effect of early infestation on crop development and ultimate yield of cotton.

Experimental

The experiment was established within a 7 acre cotton crop grown for various experiments at the Narrabri Agricultural Research Station.

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The land was ploughed to a depth of 10 inches in winter, graded, then worked with a chisel plough and scarifier. Furrowing-out at 38 inches was followed by a 10-inch pre-planting furrow irrigation on 11 October. The variety Deltapine Smoothleaf, planted on 26 October 1963, was thinned to 3 to 4 plants per foot. Rotary spindle weeders were used on 19 November and an inter-row tyne cultivator on 26 November, 17 December, 2 January, 30 January and 7 February. An 8-inch furrow irrigation on 10 January was followed two days later by cyclonic rains totalling 6½ inches and the whole area was inundated for 48 hours. A further 6-inch furrow irrigation was applied on 15 February.

The first flowers appeared in early January. Subsequent growth was influenced by the degree of control of *Heliothis* obtained by the sprays applied on 5 February. Bollburst commenced late in March and the first pickings were taken on 5-6 May. Ground frosts occurred from 23 May. Rain on 31 May and on 9 June, totalling 2 inches, coupled with dull weather and high humidity, delayed the second pickings until 18 June.

Insecticide formulations

DDT 25 per cent w/v miscible oil emulsion concentrate;

Endrin 20 per cent w/v miscible oil emulsion concentrate;

Endosulphan 30 per cent w/v miscible oil emulsion concentrate; and

Carbaryl 80 per cent w/w wettable powder.

Spray applications

The plots for this experiment were parallel to one another, 4 rows in width with length varying from 170 to 190 yards. Treatments were replicated three times.

Plots were sprayed with a tractor mounted boom, covering four rows of plants in one swath, on three occasions: 8 January, 22 January and 5 February. The following treatments were applied:—

DDT 16 oz. plus endrin 4 oz. per acre;

Endosulphan 10½ oz. per acre;

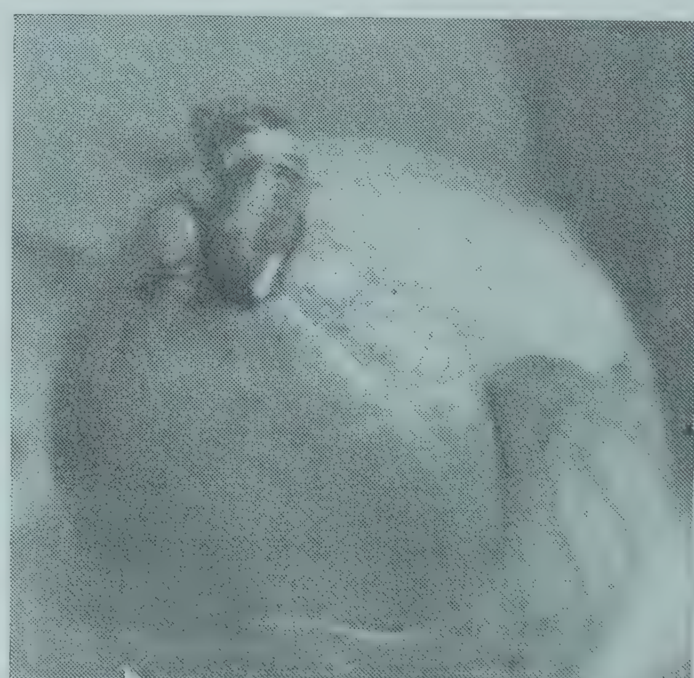
Carbaryl 12 oz. per acre; and

Untreated.

Thirty gallons of spray per acre were used in the first application. This was increased to 40 gallons for the second and third treatments.

All the cotton on Narrabri Agricultural Research Station was sprayed by aircraft with about 5 gal. per acre of DDT/endrin spray on 26 February, 11 March and 4 April to protect the various experimental plantings from insect damage, especially by

Common bollworm—larva of *Heliothis* sp.



The rough bollworm *Earias huegeli,* was more common late in the season.

First spray applicati on 8 January 1964

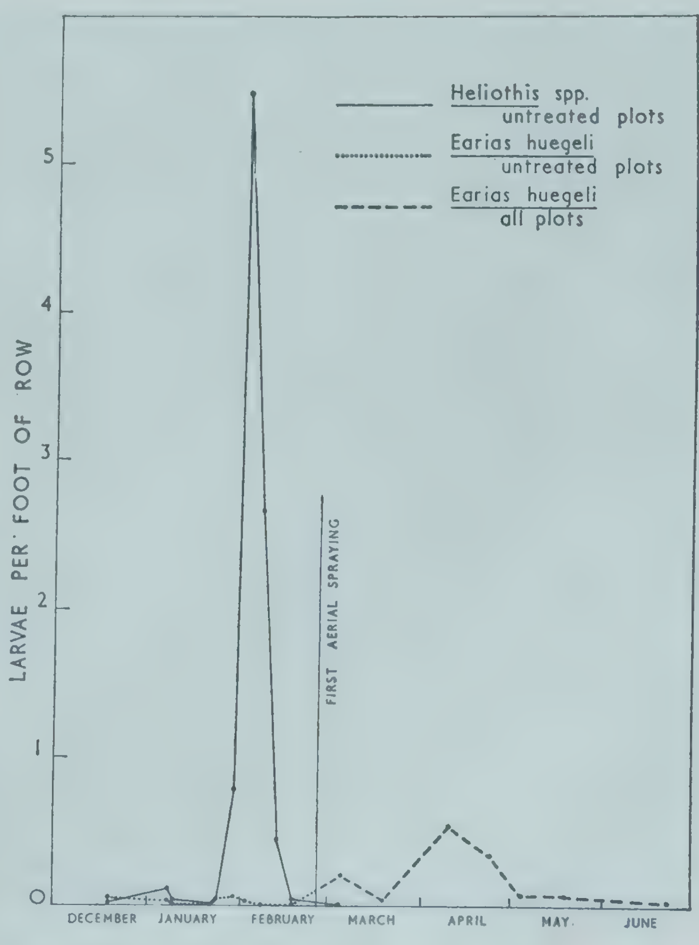
the rough bollworm. For each aerial application the DDT rate was 1 lb. per acre. The endrin rate was 4 oz. per acre for the first, and 8 oz. per acre for the subsequent applications. The ground equipment available was unsuitable for treating the crops after 5 February.

RESULTS

Caterpillar counts

Numbers of larvae were recorded from plants in a randomly selected 10-ft. length in each of the two central rows of each plot. Counts were taken from 7 January to 18 February. Further counts of larvae were made at intervals from the first aircraft spraying until mid-June.

The incidence of *Heliothis* spp. and *Earias huegeli* in untreated plots is indicated in the graph. Small numbers of *Heliothis* larvae first appeared on 7 January but none were present immediately after the cyclonic rains of 12-13 January. Heavy egg laying in late January resulted in a peak of over 5 caterpillars per foot of row in the untreated plots by 4 February. A steep de-



Populations of *Heliothis* spp. and *Earias huegeli,* December 1963, to June 1964

cline in numbers then took place and no further infestations occurred after mid-February.

Earias were first noted on 18 December, but numbers remained insignificant until late in February. A peak population of 0.6 larvae per foot of row was recorded on 9 April. After this date there was a gradual decline as temperatures dropped and the crop matured.

Damage counts

Each fortnight from 5 February until 18 May, four plants, randomly selected, were removed from the three replicates of each treatment. Damaged and undamaged squares and bolls were counted.

The effectiveness of the ground treatments for *Heliothis* control is shown by the larval counts (table 1) and the percentage of damaged fruiting forms (table 2). Further evidence of the effectiveness is the number of bolls retained (table 3) and the stimulated late square formation in the absence of *Heliothis* control (table 4).

Yield measurements

Two 1/100 acre quadrats were marked out on the two central rows of each plot, about 50 yards from either end. Two hand-pickings of mature cotton were made in each quadrat, the first on 5 May and the second on 18 June. The treatment yield for each picking was converted to lb. seed cotton per acre. The total yields from the DDT-endrin and endosulphan plots were significantly higher than from the carbaryl and control plots (table 5).

DISCUSSION

This experiment has shown that control of a late-January infestation of *Heliothis* in irrigated cotton sown in late October in the Namoi region of New South Wales can prevent severe yield reductions. Nevertheless the damage to fruiting forms (table 2) caused by larvae which developed after heavy egg-laying during the fortnight between the second and third sprayings (table 1) indicates the need for careful timing of spray applications.

Plants selected at random from the treatments, 18 May 1964. Left to right: untreated, carbaryl, endosulphan, DDT-endrin.

Table 1.—Control of Heliothis spp. in cotton

Treatment	Number of caterpillars counted along 60 feet of row											
	7 Jan	8 Jan	9 Jan	21 Jan	22 Jan	23 Jan	29 Jan	4 Feb	5 Feb	7 Feb	12 Feb	18 Feb
DDT 16 oz. p.p.i. + Endrin 4 oz. a.i. per acre	7	First treatments applied	0	0	Second treatments applied	0	12	78	Third treatments applied	0	1	0
Endosulphan 10½ oz. a.i. per acre ...	7		1	1		0	42	80		10	12	5
Carbaryl 12 oz. a.i. per acre	5		4	0		0	42	315		27	16	5
Control — no insecticide	6		3	0		1	46	328		159	27	1

Table 2.—Fruiting forms showing damage—percentages and angular values

Date assessed	DDT-Endrin		Endosulphan		Carbaryl		No insecticide		Difference for Significance*
	Percent		Percent		Percent		Percent		
5-2-64 ...	38·0	38·06°	27·4	31·53°	79·6	63·12°	86·0	68·07°	6·8°
17-2-64 ...	3·8	11·28°	14·6	22·46°	22·3	28·16°	45·2	45·22°	9·9°
4-3-64 ...	3·5	10·73°	4·5	12·22°	4·5	12·27°	13·2	21·27°	4·5°

* Percentages of fruiting forms showing damage were transformed using the angular transformation. The statistical analyses were performed on these angles and the differences for significance apply to the angular values.

Table 3.—Total number of bolls on 12 random plants

Date Assessed	DDT-Endrin	Endosulphan	Carbaryl	No Insecticide
5-2-64 ...	33	45	44	30
17-2-64 ...	167	143	59	29
4-3-64 ...	199	176	63	9
19-3-64 ...	206	196	84	20
8-4-64 ...	234 (62 burst)	215 (49 burst)	212 (29 burst)	173 (1 burst)
21-4-64 ...	212 (80 burst)	224 (68 burst)	194 (31 burst)	204 (5 burst)
4-5-64 ...	154 (95 burst)	163 (102 burst)	216 (38 burst)	174 (0 burst)
18-5-64 ...	206 (178 burst)	215 (155 burst)	184 (51 burst)	188 (1 burst)

Table 4.—Total number of squares on 12 random plants

Date Assessed		DDT-Endrin	Endosulphan	Carbaryl	No Insecticide
5-2-64	..	226	250	194	166
17-2-64	..	193	151	113	43
4-3-64	..	177	214	231	276
19-3-64	..	190	236	307	356
8-4-64	..	11	23	130	173
21-4-64	..	1	5	8	51
4-5-64	..	2	5	44	29
18-5-64	..	0	0	1	20

Table 5.—Yields of seed cotton (lb. per acre)

Date of Pick	DDT-Endrin	Endosulphan	Carbaryl	No insecticide	Difference for significance
5-5-64	2347	2027	767	76	696
18-6-64	640	720	480	100	79
Total ..	2987	2747	1247	176	749

Fortnightly DDT-endrin and endosulphan spray schedules provided excellent control of *Heliothis* with some residual effect evident after the second treatments on 22 January (table 1) and these sprays gave better protection of fruiting forms than carbaryl during the critical period in early February (table 2). The ultimate yield of seed cotton was better for all three treatments than for the untreated control. Carbaryl, however, did not give satisfactory control (table 5).

Since the cotton plant is able to recover from considerable insect damage to early fruiting forms, the need for early *Heliothis* control depends on the length of the growing season. McKinlay and Geering (1957) and Coaker (1957) demonstrated in Uganda and Tanganyika that the ultimate yield may be unaffected if the season is long enough. When the season was shortened by a late sowing at Ilonga, Eastern Tanganyika, and *Heliothis* was not controlled, a heavy reduction in yield occurred (McKinlay and Geering, 1957). Passlow (1959, 1961) made similar findings for cotton in Central Queensland. He demonstrated that whilst uncontrolled *Heliothis* attack may decrease the first pick, the total yield of untreated cotton is unaffected because the later maturing bolls replace those lost. The importance of length of season in the recovery of yield after loss of early bolls in this area was again shown by Passlow and Trudgian (1960).

In this experiment, the boll-counts on 4 March represented bolls protected from the late-January attack plus those set during February from protected squares. The loss of early-set bolls in the control and carbaryl plots stimulated vigorous growth and a prolific burst of squaring by mid-March. By 8 April boll numbers were almost as high as in the DDT-endrin and endosulphan treatments. Few of the late-set bolls had matured by 18 May (table 3) and ground frosts from 23 May, combined with low day temperatures and intermittent storms, retarded development and prevented further boll-burst. It therefore appears unlikely that yield losses can be balanced by the late

developing bolls following early *Heliothis* attack of cotton in the Namoi region of New South Wales.

The pest status of *Earias huegeli* was not determined in this work. The pest did not reach high numbers, even in untreated plots, before the first aerial spray on 26 February. A low population of larvae persisted despite this and two further blanket sprays with DDT-endrin.

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CYCLAMEN CULTURE

F. A. BAGSHAW

Few plants grown for glasshouse or indoor decoration are more beautiful and popular than cyclamen. Of the many different species of cyclamen, the one most widely grown for pot culture is *Cyclamen persicum*.

Cyclamen can be grown from seed or tubers, but best results come from treating the plant as an annual and raising new plants from seed each year. Plants grown from the previous year's tubers seldom flower prolifically in subsequent years.

Raising plants

The cyclamen is a winter flowering plant which takes from 12 to 15 months to flower from seed. Seed should, therefore, be sown about February or March for flowering in the winter of the following year. Later sowings can be made but earlier sowing results in larger plants and more blooms.

There are quite a number of mixtures that should prove suitable as a medium for cyclamen culture. The object is to provide one which drains reasonably well and contains a fair proportion of organic material and plant foods.

The following mixture has been found suitable for seed sowing and growing plants in pots:

7 parts of good quality loam.

3 parts of leaf mould or peat moss.

2 parts of coarse sand.

All parts are by volume and for each bushel* of the mixture add 3 oz. of blood and bone, 1½ oz. of superphosphate, 1 oz. of sulphate of potash and 1 oz. of calcium carbonate (agricultural lime). Loam and leaf mould should be sieved to remove lumps. The mixture is best prepared 2 to 3 weeks before sowing or planting, and should be kept moist.

Cyclamen are not very susceptible to root and crown rots, but it is sound practice to sterilize the soil and containers before sow-

* For this purpose, a container 10 by 10 by 22 inches may be said to hold a bushel.

The Author: Mr. F. Bagshaw, Home Garden Inquiry Officer, Farrer Place, Sydney.

Cyclamen

ing or planting. Formalin is one of the best fungicides to use for this purpose, although it is not very effective in controlling soil pests or nematodes. The details of the formalin treatment are:—one part of commercial formalin is diluted with fifty parts of water to make a sterilizing solution. The mixture is applied at the rate of ½ to 1½ gallons to the square foot, the amount depending on the quantity necessary to saturate the soil. The soil is then covered for 12 hours with clean boards, bagging or several thicknesses of newspaper. After the covers are removed the soil is stirred several times during the next two weeks to allow the fumes to escape before planting. This period of two weeks may be shortened slightly by more frequent stirring of the soil.

Pots, seedling boxes and tools can be sterilized by soaking them in the formalin solution for 10 minutes. The pots and boxes should not be used till the odour of the formalin is no longer evident.

Sowing seed

The seed should be sown in well drained boxes filled with the prepared mixture. Seed is large enough to be sown individually in drills about 1 inch apart with ½ to 1 inch between seeds. Seed should be lightly covered with moist mixture and firmed down with a wooden float.

The soil should be kept moist, and to facilitate this a sheet of glass, polythene or several thicknesses of newspaper should be placed over the seed box. The covering should be removed as soon as the seedlings begin to show.

The seed is erratic in germinating and it might be 6 to 8 weeks before all the seedlings appear, although usually most of them appear in about 4 weeks.

Growing on

Following germination, the seedlings should be pricked out into boxes at 2 in. spacings when they have reached a size convenient to handle. They must be placed in a well lighted position. All weak, spindly seedlings should be discarded. The seedlings can be left in the boxes until the foliage of adjacent plants is touching. Depending on the manner in which they are to be grown they should then be potted into 3 in. pots or planted in beds. After transplanting or potting, water should be given sparingly until new growth commences.

It is normal for the cyclamen to grow with most of its tuber above soil level and *at no stage should the tuber be completely covered with soil* otherwise rotting of the leaf stalks is likely.

If plants are to be grown direct in beds the seedlings should be graded and larger plants kept together so they do not overgrow smaller ones. The soil should be at least six inches deep, well drained and preferably prepared several weeks beforehand. The soil should contain a good deal of compost, decayed animal manure or peat moss. A complete fertilizer at the rate of 2 to 4 oz. to the square yard should also be given.

Where plants are to be flowered in beds they should be planted at least 12 in. apart each way. Otherwise, they can be planted 5 in. apart in the bed and when the foliage of adjacent plants is touching, potted into 5 or 6 in. pots.

However, in most cases the seedlings are transplanted from the seed box into 3 in. pots. Then, as they increase in size, they are again transplanted to "fives" or "sixes".

Raising plants from tubers

Tubers of the previous season which have been dried off in their pots should be soaked in water without removal from the pots and then set aside until new growth commences. They are then taken out of the pots, removing as much of the old mixture as possible without unduly disturbing the roots, and re-potted into suitable sized pots in a fresh medium. The crown of the tuber must be above soil level. Vigorous, well developed plants grown from old tubers might need 7 or 8 in. pots for the final potting.

Shading and general care

Regular watering is essential. The frequency of watering will depend mainly on weather conditions and whether the plants are grown under glass or in semi-shaded areas. The main object is to keep the

plants reasonably moist at all times. Syringing of the foliage with water several times a day, particularly during hot, dry periods, also is advisable.

Cyclamen need protection from strong sun. Shade can be provided by covering plants with hessian, tea tree or lath covers. If the plants are in a glasshouse they can be protected by whitewashing the glass.

In many parts of New South Wales, summer temperatures are high. Under glasshouse conditions it is difficult to keep temperatures sufficiently low, and at the same time allow enough light for best results.

Whitewashing of the glass is a practical way of keeping the temperature within reasonable limits. However, if applied too heavily, whitewashing can cause spindly plants by preventing them getting sufficient light. Calico blinds are very satisfactory for shading but they require constant attention, and are rolled up when not in use. Plastic shade cloth, available in a range to give varying degrees of shade, is probably the most satisfactory.

Good results can be obtained by growing the plants outside under semi-shade and transferring them to a well lighted, well ventilated glasshouse or similar structure when flowering commences.

Watering of floors and benches, and syringing of foliage will assist in reducing temperature when necessary. Free circulation of air is essential. Plants should be adequately spaced; closely packed plants are likely to become spindly and are more likely to be affected by disease.

Weekly applications of liquid animal manure or soluble fertilizer mixtures will be beneficial when the plants become pot bound in the final pot.

If tubers are to be kept for further cultivation, water should be restricted after flowering and the plants allowed to dry off. The tubers are retained in their pots until required the following season, with the soil kept just moist enought to prevent excessive shrivelling of the tubers.

Pests and diseases

The most common disease of cyclamen is grey mould, caused by the parasitic fungus *Botrytis cinerea*. This produces a grey, furry mass on leaves, stems and flowers, and attacks either dead or living parts. Grey mould can cause considerable damage to plants growing in glasshouses during the cooler months.

Fungicides are of little value in controlling grey mould. Special care taken in regard to hygiene, adequate spacing and ventilation, correct temperature and humidity can prevent development of the disease.

The cyclamen mite, *Steneotarsonemus pallidus* is probably the most serious pest of cyclamen. The adult mites are very small and not readily seen with the naked eye. Flowers, foliage and buds are liable to attack.

Infested foliage becomes twisted and distorted, flowers develop spots and streaks, and buds are malformed and often fail to open. Young foliage and buds coming from the crown of the plant are very liable to attack.

The cyclamen mite can be controlled by thorough spraying with 0.05 per cent Kelthane ® (that is, 1 fl. oz. of a 30 per cent Kelthane emulsion in $3\frac{3}{4}$ gal. of water).

Heavily infested plants would best be destroyed by burning. ●

® = registered trade name.

How Often Do You See the Bottom of the Ironing Basket ?

NANCY FOSKETT

RECENTLY I asked a group of women what were among their day-to-day problems that they had difficulty solving. Among their answers was "I never see the bottom of my ironing basket".

Later, this question was given to a group of women to discuss at one of our homemakers' schools. I think you will find their suggestions helpful if *you* don't see the bottom of your ironing basket often enough.

A very important point made was to remember that washing machines wash—they do not do the ironing, so don't be too hasty in tossing in only half-soiled articles.

Quite a number of the group thought it worthwhile to spend time hanging clothes straight on the line—smoothing out folds, edges and creases, and folding them with care as articles are taken off the line. This means fewer creases to be ironed out, and less time per article which brings the bottom of the basket nearer.

All agreed that while most non-iron fabrics do in fact need a light touching-up, non-iron and minimum-iron fabrics are a help.

Many suggested using place mats rather than tablecloths during busy periods; for example, shearing, harvesting, school holidays, Christmas, sowing, and showtime.

Others advocated the use of plastic or seersucker clothes at these times, and all agreed paper table napkins had many advantages.

A mother of a young family strongly recommended simple styles for children's clothes as they are easier and much quicker to iron.

Flat braid trimmings were favoured in place of frills and bows, while patterned fabrics that needed no trimming were popular. This lead another to observe that the same idea should be followed for their own everyday frocks.

Many favoured having an ironing board always set up with the iron ready to use. Others found it helped to know how long it took to iron a shirt, half a dozen table napkins, four pillow cases, a dress and so on.

One woman said that since she had realised she could do a worthwhile amount of ironing in ten to fifteen minutes she found she generally coped with at least half the household ironing without having to plan a long period for it.

"Of course", she added, "I wouldn't if I didn't have the ironing board set up all the time. This way I put to good use the time I wait for the cake to finish cooking or for John and the boys to get washed-up for dinner."

Something which many had not realised was that *where* they iron has a lot to do with getting it done. The essentials are good, shadowless light, coolness in summer, warmth in winter and, at times, company.

This particular approach recalled one friend who declared she got her ironing done more quickly in the winter warmth of the verandah looking out over the paddocks to the hills.

"And these days", said one modern, "I get mine done while I watch TV."

And there were those whose *attitude* helped them to get the job done—they looked on ironing as the last of the processes of laundering, when the total job was finished and something could be seen for their efforts. ●

The Author: Miss Nancy Foskett, Senior Extension Officer (Women's Service), Farrer Place, Sydney.

" Hanging by a Thread "

R. Smith

HAVE YOU EVER THOUGHT how many times each day lives depend on thread? The safety belt in your car—the rope of your child's swing—the parachute jumper's harness and canopy—the surgeon's special thread.

Threads in one form or another have been used since the days of the caveman. Cavemen used threads, albeit in a rough form, to hold together the animal skins they wore.

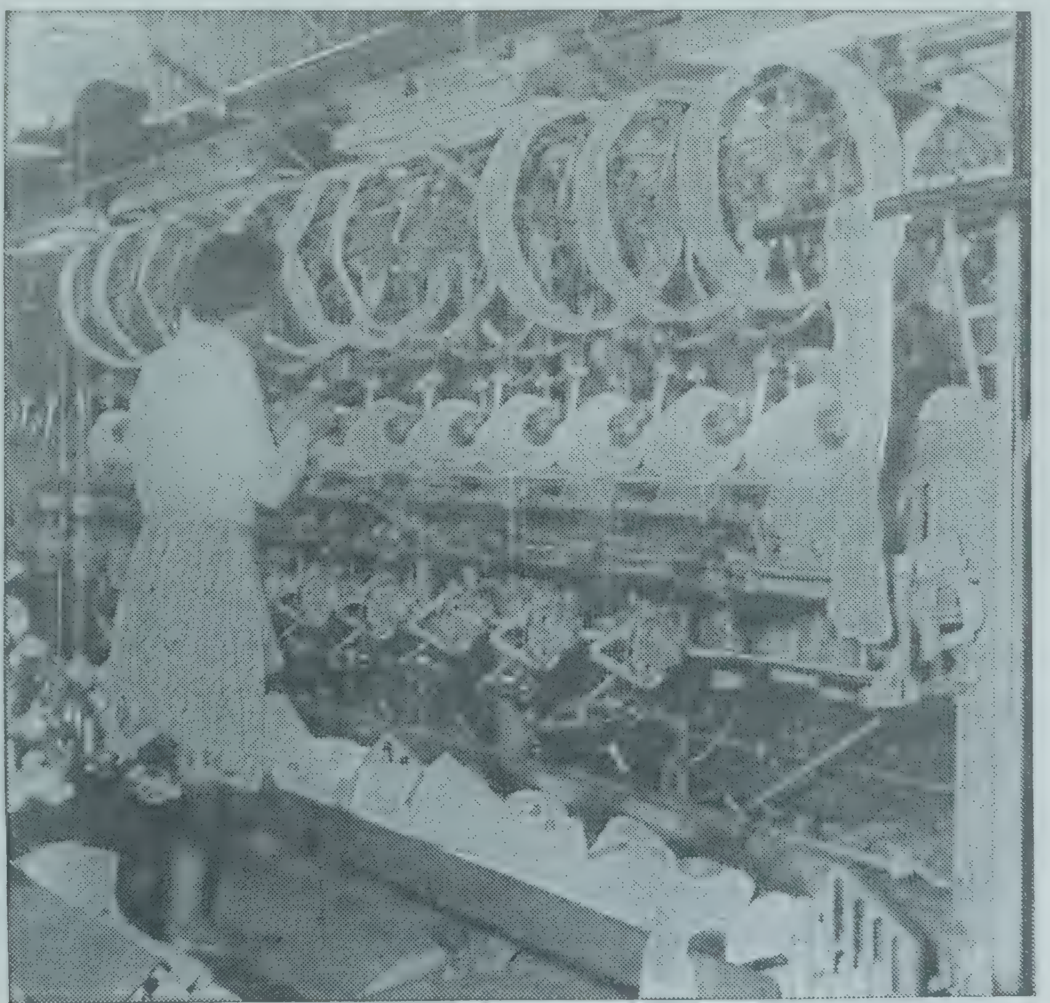
As time passed, the nature of threads changed, but even the ancient Egyptians were spinning cotton to be used either as thread or in the weft and warp of their fabrics.

The Author: Mr. R. Smith, Deputy Managing Director, Australian Sewings Pty. Ltd.

Today the variety of threads available to industry is very complex. Most factories in the garment industry use special sewing machines and special threads for the various operations they have to perform.

In the realm of the housewife, threads have also developed to keep pace with the development of fabrics. This is particularly so with fabrics made from man-made fibres, where the use of the wrong thread can cause unsightly puckering. By and large it is true to say that when using synthetic materials one should use synthetic threads.

The average housewife uses her one machine for a multitude of jobs. She stitches patches into Johnny's trousers and



Many kinds of threads are used in modern industry, and much ingenious machinery is used in their preparation.

then turns to making her daughter a dress from some fine gingham, and perhaps next she is sewing bed sheets. In these various operations, how many housewives think of changing the thread, the needle and the tension of their machines? You will appreciate that there is vast difference between the drill used in Johnny's trousers and his sister's gingham frock, yet most housewives use the same thread, the same needle and do not change the tension. Modern domestic sewing machines are tending to run faster than before, and it is important, therefore, if the best results are to be obtained, that needle changes be made for stitching vastly different weights of material.

For general purpose sewing a No. 14 needle with a No. 40 Mercerised thread is probably the solution. With finer fabrics a No. 11 or No. 12 needle with a ticket No. 50 Mercerised thread is the answer. With exceptionally fine fabrics a No. 10 needle may be needed and the use of a 75 denier "Terylene" thread.

It would seem that the housewife's lot in doing a little sewing is becoming much more complicated, like many other jobs she has to perform. One thing to be certain of, however, is always to use a good thread. You may pay a little more for it, but in the long run it is probably the cheapest part of any sewing work you do. ●

Home Orchard Notes for February

Cultivation

Pay attention to weed control, but do not stir the soil unnecessarily.

Budding

See notes in last month's *Agricultural Gazette.*

Manuring

Citrus trees will benefit from fertilizer applied either this month or early in March. (See also notes in May *Agricultural Gazette.*)

Planting

Citrus trees may be planted in February, if on rough lemon root-stock, but not later than early in March. If the area is frosty, however, it is better to wait until spring.

Trees on trifoliata rootstock are best suited for September planting.

Irrigation

Water regularly if the weather is dry, and make sure that citrus trees do not suffer from lack of moisture.

Remember that sprays to control some pests and diseases can cause defoliation and fruit drop if the soil is dry.

Disease and pest control

Codling moth.—In the coastal centres harvesting will be finished this month. Clean up all fruit.

Fruit fly—Control measures must be continued for at least a month after the last fruit has been harvested. This will help to reduce fruit fly numbers next season. Destroy, by burning, residue of old crops of tomatoes.

White wax scale—See notes in November *Agricultural Gazette.* Increase strength of soda spray to 1½ lb. soda to 4 gallons water.

Red scale—Spray with white oil. See notes in November *Agricultural Gazette.*

Rust of peaches, nectarines, and plums—Repeat the January rust control spray if rust can be detected.

Fruit tree moth borer—Watch out for gum spots exuding from the trunks of trees or any evidence of sawdust-like material mixed with webbing.

If evident, scrape away this material and paint this area with 1 part DDT emulsion diluted with 3 parts of water. Some of this liquid may also be injected into any holes or tunnels present, using an oil can. ●

Proper Care Prolongs the Life of Foundation Garments

NINA MARTINDALE

"THE way we put on and take off our girdles influences the length of their lives in our wardrobes" states an American home economics publication.

We are advised when putting step-ins on to pull them by folding the garment in half "top towards bottom" and then pulling them gently into the wearing position on the hips using only the balls of our fingers.

Then fasten the back suspenders first.

When removing the step-ins, the procedure is reversed. Halve the girdle by folding upwards towards the waist before pulling it off.

The rubber and spandex elastic fibres from which girdles, step-ins and sections of corsets and brassieres are made today, require special washing care.

As elastic fibres have an affinity with body oils and perspiration, which cause deterioration and yellowing in a garment, it is important to wash all foundation garments as frequently as possible.

Some labels and tags provide explicit instructions on care and washing of a particular brand. Some merely state that the garment is "machine washable".

Please note that machine washing of foundation garments is only satisfactory when the remainder of the washing load is but slightly soiled and can also be washed at a luke warm temperature setting.

The Author: Mrs. Nina Martindale, Extension Officer (Women's Service), Farrer Place, Sydney.

To sum up, we would be wise to learn the correct methods for handling, that is, putting on, taking off, washing and drying, our elasticised undergarments to ensure the best wear from them. Still better we would be wise to budget for two of a kind to double the life of the type that suits our individual body contours.

The following hand washing method applies to all elasticised garments and can be used quite satisfactorily with the minimum amount of water wastage:

- Soak the soiled garment for 5 to 10 minutes in luke warm sudsy water, using mild soap flakes or a recommended liquid detergent. Over-soaking will not help as dirt particles have a tendency to sink back into the fibres after 10 minutes.
- Use a soft nail brush to scrub gently all the soiled areas or the whole of the garment.
- Squeeze more suds through the garment after scrubbing and remember to change the washing water if necessary.
- Rinse in clean water, removing excess moisture by blotting and rolling in a clean bath towel.
- Smooth into shape for drying away from direct heat or sunlight.
- Hang over a string or an old stocking to avoid, whenever possible, the use of pegs directly on the garment.

N.B. Wash coloured foundation garments separately. •

TUBERCULOSIS-FREE HERDS

The following herds have been declared free of tuberculosis in accordance with the requirements of the scheme of certifying herds tubercle-free, and unless otherwise declared, this certification remains in force until the date shown in respect of each herd.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Australian Missionary College, Cooranbong (Jerseys)	123	Sept., 1965
Beddie, R. H., Old Grenfell Road, Forbes (Shorthorns)	124	Mar., 1965
Bonnington, R. A., "Leiroy", Shorthorn Stud, "Spring Camp". Curban (Beef Shorthorns)	77	Nov., 1965
Burke, J. & M. P., "Golden Valley", Forbes Road, Cowra (Beef Shorthorns)	62	Mar., 1965
Burnside Presbyterian Orphan Homes, North Parramatta (A.I.S.)	70	July, 1965
Cochrane, R. & C. C., "Parrabel Stud", Bega (Jerseys)	160	April, 1965
De La Salle College, Castle Hill (Ayrshires)	46	July, 1966
Eather, A. D. & J., "Milgarra", Bunnan (Beef Shorthorns)	65	Sept., 1965
Elsinora Pty. Ltd., Manna Stn., Forbes	485	June, 1965
Everingham, C., Taree Vale Jersey Stud, Taree	122	Jan., 1965
Ewin, N., "Edenview", Greghamstown, via Blayney (A.I.S.)	60	May, 1965
Fairbairn, C. P. & C., Woomargamma Stn., Hume (Beef Shorthorns)	391	Nov., 1964
Farrer Memorial High School, Nemingha (A.I.S.)	93	May, 1964
Fleming, T. H. & Sons, "Russley", Aberdeen (Polled Shorthorns)	337	Aug., 1965
Franciscan Missionaries of Mary, Range Road, Mittagong (Friesians)	83	Mar., 1965
Freudenstein, F. J. & G. F., "Chippendale". Grenfell Road, Young (Beef Shorthorns)	89	June, 1966
Freudenstein, W. J. A. & Son, "Chippendale", Grenfell Road, Young (Beef Shorthorns)	133	June, 1966
Glen Mitchell Pastoral Co., Wellington (Poll Shorthorns)	170	April, 1966
Grafton Experiment Farm, Grafton (A.I.S. Angus)	397	Aug., 1964
Greaves, J. A., "Baroona", R.M.B. 63, West Wyalong (Beef Shorthorns)	44	Nov., 1965
Grey, T. J., Estate, "The Meadows", Albion Park (Jerseys)	147	Sept., 1966
Hawkesbury Agricultural College, Richmond	247	June, 1965
Hill, R. H. and Sons, Bulliac (A.I.S., Jerseys)	71	Oct., 1964
Hurlstone Agricultural High School, Glenfield (Ayrshires)	67	Aug., 1965
Limond Bros., Morisset (Ayrshires)	99	Aug., 1965
McSweeney, W. J., "The Rivers", Canowindra (Polled Shorthorns)	83	May, 1965
Maloney, D., "Heathvale", Broadwater (Jerseys)	46	Sept., 1966
Markham, J. & E., "Mara", Branxton (Jerseys)	57	Aug., 1965
Mullee Stud Farms Pty. Ltd., "Nairobi", Scone (Poll Herefords)	123	May, 1966
Mutton, J. T. & Sons., Bolwarra, Maitland (Jerseys)	100	Feb., 1965
O'Dea, C., "Sunnyside", Nepean Stud, Nth. Richmond (Friesians)	109	Mar., 1966
Peel River Land and Mineral Co., "Goonoo Goonoo", Tamworth (Polled Shorthorns)	230	Oct., 1964
Pratt, H. F., "Field View", Reserve Creek via Murwillumbah	135	Nov., 1964
Ray Bros., "Wellington Park", Picton (Friesians and Guernseys)	530	Aug., 1964
Reid, D. B., "Evendale", Sutton Forest (Angus)	130	Dec., 1964
Reid, G. T., "Narrengullen", Yass (Angus)	540	June, 1965
St. Vincent's Boys' Home, Westmead (A.I.S.)	16	June, 1965
Scobie, C. & Son, Abingdon Jersey Stud, Lorn, Maitland	143	Sept., 1964

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds—*continued*		
Simpson, F. S., "Gunnawarra", Gulargambone (Beef Shorthorns)	238	Aug., 1965
Simson, J. N., "Nowley", Spring Ridge (Shorthorns)	227	Feb., 1966
The Scots School, Bathurst (Friesians)	31	Nov., 1965
Training Farm for Boys, Berry (A.I.S.)	153	Jan., 1965
Trangie Agricultural Research Station, Trangie (Angus)	175	May, 1966
Vitnell, A., Dalwood (A.I.S.)	115	Feb., 1965
Wagga Wagga Agricultural College (Jerseys, Poll Shorthorn)	167	May 1965
Walsh, Mrs. H. R., "Water View", Cowra (Beef Shorthorns)	120	Mar., 1965
Waters, G., "Willow Dell" Jersey Stud, "Boongala", Deniliquin	139	Mar., 1965
White, H. F., Bald Blair, Guyra (A.A.)	147	June, 1965
Willis, R. N. & D. M., Westbrook, Mt. Hunter, via Camden (Ayrshire)	168	Nov., 1964
Wollongbar Agricultural Research Station, Wollongbar (Guernseys, A.A.)	145	June, 1964
Wombramurra Pty. Ltd., "Wombramurra", Nundle (Devon)	136	April, 1966
Wright, Miss I. M., "Awatea Jersey Stud", Paddy's Plains, North Dorrigo	56	Dec., 1964
Yanco Agricultural High School, Yanco (Jerseys)	119	Oct., 1964
Yanco Agricultural Research Station (Jerseys, Guernseys)	127	Dec., 1965
Herds Other than Registered Stud Herds		
Adams, B. & L., "Garryowen", Wallamore	67	Nov., 1964
Adastra Dairies Pty. Ltd., Terrace Rd., North Richmond	106	July, 1966
Baker, R. W., Luskintyre, Lochinvar	74	Oct., 1966
Barnardo's Homes Dr. Tooloogan Vale, Scone	157	Feb., 1965
Bennett, J. F. M., "Oaklands", Pambula	90	May, 1965
Bethsam Holiness Mission, Wyee	23	Feb., 1965
Bladwell, W. R., "Loloma" Goulburn	128	Dec., 1965
Bowen, A. H., Stroud	73	April, 1966
Bridge & Bowden, Mill Creek, Stroud Road	47	April, 1965
Brookfield Afforestation Camp, Mannus	268	May, 1965
Brown, R., Valery	58	Aug., 1965
Camden Park Estate, Menangle	2715	Nov., 1964
Charlton, R. J., Caniba Street, Lismore	66	Dec., 1965
Chesham, C. H., Picton Road, The Oaks	45	April, 1965
Child Welfare Dept., "Werrington Park", St. Marys (A.I.S.)	34	Feb., 1965
Coilsfield Pty. Ltd., "Coilsfield", Orange	244	Dec., 1965
Cole, E. J. & Sons, Lochiel	127	April, 1966
Cole, G., South Pambula	53	Oct., 1964
C. V. and H. G. Denton, "Yarrawood Farm", Merimbula	91	May, 1965
Croagh Patrick Orphanage, Park St., Orange	61	Feb., 1966
Duck Creek Farm, Wollongbar	118	June, 1964
Dunshire, J. S., "Glenara", Riverview Rd., Lansvale	164	May, 1965
Ellensville Est., "Ellensville", Glenmore, via Camden	153	Dec., 1964
Ellwood, H., Attwater Avenue, Cessnock	61	Mar., 1966
Enright, M. (Mrs.), "Hinton Vale", Hinton	95	June, 1966
Fairbridge Farm School, Molong	56	Jan., 1965
Farley, D. J., Stroud	88	Dec., 1965
Foley, L. F., Lucknow, via Orange	29	Dec., 1965
Forster & Sons, "Abington", Bundarra	53	April, 1966
Franciscan Fathers, Maryfields, Campbelltown	50	April, 1966
Gilbert, A. E., Mill Creek, Stroud	90	Aug., 1966
Gorton, I. E., Stroud Road, N.S.W.	72	Dec., 1964
Greenham, J. R., Hill Creek, Stroud	45	Sept., 1965
Harrington, J. B. & J., "Mt. Erin", Campbelltown	97	Nov., 1965

Tuberculosis-free Herds—continued

Owner and Address	Number Tested	Expiry Date
Herds other than Registered Stud Herds—*continued*		
Harrington, P. P., "Glen Erin", Leumeah	69	Nov., 1965
Hawkey, H. R., "Trevone", Menangle	271	Nov., 1964
Hawkins, G. A., Freemans Reach	63	Mar., 1965
Her Majesty's Training Centre, Emu Plains	164	Feb. 1965
Her Majesty's Training Centre, Goulburn	31	Mar., 1965
Hill, W. S., "Questwill", Crooked Lane, North Richmond	55	July, 1966
Hill, R. H. & Sons, Bulliac	107	Oct., 1966
Johnson, J. R. & P. M., Wallamore Road, Tamworth	123	July, 1965
Kenmore Hospital, Kenmore	120	Mar., 1965
Lee, H. W. & Son, Taree	34	Nov., 1964
MacArthur Stanham Holdings Pty. Ltd., Camden Park, Menangle	276	Oct., 1965
McGrogan, J. Percy Street, Singleton	80	Jan., 1965
Margery, G. W., Stroud Road, Stroud	68	Aug., 1965
Merchant, Mrs. P., East Gresford	85	Dec., 1965
Moffit, C. E., Central Tilba	149	Jan. 1964
Monkittee Pastoral Co., Braidwood	47	Nov., 1963
Morisset Hospital, Morisset	84	Mar. 1965
Moxham Bros., "Mullengudgery", Mullengudgery	106	Dec., 1964
Mt. Penang Training School (Gosford Farm Homes), Gosford	68	May, 1965
Naroo Pastoral Co. Pty. Ltd., "Jemalong", Forbes	403	Jan., 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong	101	Sept. 1965
O'Dea, C., "Sunnyside", North Richmond	94	Mar., 1963
Odewahn, R., 113 Argyle St., Parramatta	20	Sept., 1965
North Parramatta Psychiatric Centre	48	Aug., 1965
Passionist Fathers, Mary's Mount, Goulburn	16	Mar., 1965
Perry, K. T., Millingandi, via Eden	69	July, 1965
Pitt, S. R., Wylie's Flat, via Singleton	44	July, 1966
Ramsey, E. J., "Manor Park", Parkes	100	Feb., 1964
Ryan, P., Hallsville	33	July, 1965
Herds Other than Registered Stud Herds—*continued*		
Rydalmere Hospital, Rydalmere	28	Nov., 1965
Scott, S., Mullumbimby	71	Sept. 1966
Shelldrake Bros., "Clearview", Box 11, Picton	93	Nov., 1966
Simpson, A. T., "Kenso", Forest Road, Orange	191	April, 1966
Stinson, J. B. Church Lane, Castlereagh	88	Oct., 1966
St. John of God Training Centre, Morisset	22	Sept., 1965
St. John's Orphanage, Goulburn	9	Mar., 1965
St. Joseph's Orphanage, Cowper	70	Nov. 1964
St. Joseph's Orphanage, "Kenmore", Goulburn	5	Mar., 1965
St. Joseph's Orphanage, Kincumber	39	April, 1966
Sternbeck, C. H., Laguna House, Laguna	109	April 1965
Sydney Church of England Grammar School, Moss Vale (Jerseys)	161	Dec., 1964
Tegel, A. A. Pty. Ltd., Heath Road, Leppington	92	Nov. 1966
Thompson, L. K., "Redbourneberry", Singleton	85	Mar., 1966
Turner, R. G., "Merriwinga", Tilba Tilba	67	Sept., 1964
Training School for Boys, Mittagong	104	Feb., 1964
United Protestant Association, "Sunny Lands", Wollongbar	41	Jan., 1965
Whelan, W. G., Kiah, via Eden	46	Nov., 1964
Whelan, W. R. Bulahdelah	56	April, 1966
Wiley, F. J., Candelo	12	June, 1965
William Thompson Masonic School, Baulkham Hills	66	Sept., 1965
Williamson, R. J., Fattorini Island, Gladestone, N.S.W.	55	April, 1966
Wilson, A. J., Nicholls Street, Stroud	57	Nov., 1965
Wilson K., Woodlawn, via Lismore	59	Sept., 1964
Wood, Mrs. J., Redbourneberry, Singleton	16	Sept., 1966
Youth Welfare Association of Australia, Hopegood, Bowral	233	Dec., 1964

R. M. WATTS, Chief, Division of Animal Industry.

Brucellosis-free Herds (Cattle)

The following herds have been declared free of brucellosis in accordance with the requirements of the scheme of certifying herds brucellosis-free.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Burke, J. and M. P., "Golden Valley", Cowra (Beef Shorthorn)	58	April, 1965
De La Salle College, Oakhill, Castle Hill (Ayrshire)	46	July, 1965
Hurlstone Agricultural High School, Glenfield (Ayrshire)	67	Aug., 1965
McSweeney, W. J., "The Rivers", Canowindra (Poll Shorthorns)	83	May, 1965
"Wombramurra", Pty. Ltd., Nundle (Devon)	135	May 1965
Herds Other than Registered Stud Herds		
Fairbridge Farm School, Molong	56	Feb., 1965
Forster & Sons, "Abington", Bundarra	53	Mar., 1965
Mt. Penang Training School, Gosford	62	June, 1965
St. John of God Training Centre, Morisset	21	Feb., 1965
Training School for Boys, Mittagong	98	Feb., 1965

R. M. WATTS, Chief, Division of Animal Industry.

Brucellosis-free Herds (Swine)

The following is a list of names and addresses of owners of herds which have been declared brucellosis-free in accordance with the requirements of the Brucellosis-free Herd Scheme (Swine).

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Boyle, W. R., Alford Point Road, Menai (Tamworth and Berkshire)	15	June, 1965
Campbell, D. C., "Hillangrove Stud", Wamberal (Large White)	14	Feb., 1965
Carter, P. L., Woorak Stud, Pine Ridge, via Quirindi (Tamworth & Large White)	37	July, 1965
Draper, R. E., "Glengar", Capertee (Tamworth)	8	Nov., 1964
Farrer Memorial Agricultural High School, Nemingha (Berkshire)	9	April, 1965
Grafton Experiment Farm, Grafton (Berkshire)	15	April, 1965
Hawkesbury Agricultural College, Richmond	55	Mar., 1965
Hurlstone Agricultural High School, Glenfield (Berkshire)	7	Sept., 1965
Registered Stud Herds—*continued*		
Lambeth, A. J., "Talanga", Douglas Park (Berkshire)	11	May 1965
Maxwell, J. D. "Brooklyn", Barmedman	10	July, 1965
Mt. Penang Training School, Gosford (Berkshire)	10	June, 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong (Berkshire)	7	Aug., 1965
Wagga Agricultural College (Berkshire, Tamworth and Large White)	22	Sept. 1965
Wollongbar Agricultural Research Station, Wollongbar (Tamworth)	29	July, 1965
Yanco Agricultural High School, Yanco (Berkshire)	19	Sept., 1965
Herds Other than Registered Stud Herds		
Brookfield Afforestation Camp, Mannus	14	April, 1965

R. M. WATTS, Chief, Division of Animal Industry.

Areas Undergoing Regular Testing for Tuberculosis

Quarantine Areas (Tuberculosis)—Urban Areas

The following areas have been declared quarantine areas to ensure that a tubercule-free milk supply is available to residents. No cattle from which milk or milk products are obtained for human consumption are allowed to be kept therein unless subjected to the tuberculin test and found free from tuberculosis:

Barraba
Bingara
Braidwood
Casino
Condobolin
Coonabarabran
Coonamble
Crookwell
Glen Innes
Grenfell
Griffith
Inverell
Junee
Kempsey
Moree
Muswellbrook
Parkes
Queanbeyan
Walgett

Quarantine Areas (Tuberculosis)—Eradication Areas

The following areas have been declared quarantine areas for the purpose of eradicating tuberculosis from cattle contained therein. All owners are required to have all their cattle tested for tuberculosis when notice for testing is served:

Bellingen
Bodalla
Brushy Hill
Burringbar
Caniaba
Cessnock
Chichester
Clybucca
Comboyne
Coraki
Cumberland
Denman
Dorrigo
Dungog
Dyraaba
East Casino
East Kempsey
Fawcetts
Illawarra
Kyogle
Lavadia
Lawrence
Lower Hunter
Maitland
Manning
Milton
Moss Vale
Mullumbimby
Myrtle
Nimbin
Nth. Tweed
Salisbury
Singleton
Southgate
South Lismore
Stewart's River
Tintenbar
Tyalgum
Ulmarra
Upper Richmond
Upper Wollomba
Warkworth
West Kempsey
Wingham
Woodburn
Woodford Island

Tuberculosis Protected Area

The following areas have been declared tubercle free and no cattle are allowed to be kept therein unless subjected to the tuberculin test and found free from tuberculosis.

Bombala
Bredbo
Broken Hill
Cooma
Gulgong
Warialda

R. M. WATTS, Chief, Division of Animal Industry.

V. C. N. BLIGHT, GOVERNMENT PRINTER

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AGRICULTURAL AIRSTRIPS

A. J. Boyle

An agricultural airstrip on the property of Mr. S. C. Rutledge, "Merribee", Baerami. This typifies a good standard strip for country areas. Note the easy access, clear getaway and well-drained site.

Aerial agriculture is playing an increasingly important role in rural development throughout Australia. It has developed mainly over the last decade, and although therefore relatively new, its benefits are widely recognised.

In the early post-war period little use was made of the aeroplane in rural areas. A few hundred acres of land were treated with fertilizer by air, there was some transportation by air, and privately owned aircraft operated in country areas.

As pasture improvement and cropping areas increased in the 1950's the value of the aeroplane was realised, particularly in hilly areas where conventional treatment was not practicable. Now about 9,000,000 acres of rural land is treated by aeroplanes annually throughout Australia. Of this the New South Wales area amounts to over 5,500,000 acres. Topdressing with fertilizer constitutes most of the aerial agriculture work, with six million acres being treated annually with over 300,000 tons of fer-

The Author: Mr. A. J. Boyle, District Agronomist, Department of Agriculture, Muswellbrook.

—Catering to a Growing Need

tilizer. Aerial spraying with insecticides and herbicides varies with the seasons, but, as an example, 389,500 acres of crops and pastures were treated in New South Wales in 1962. The aeroplane shows particular promise for dealing with plague locust outbreaks.

Besides topdressing and spraying, the aeroplane is also used for seeding of pastures (500,000 acres in Australia in 1962-3) and, more recently, trial sowings of rice; aerial photography for land use and development; property inspection for rabbits or other pests, and baiting of same; stock, produce and merchandise transport, including urgently needed spare parts; and trips for stock buying at distant centres. On larger properties the aeroplane is occasionally used for inspecting dams, bores, fencing, and stock prior to and at a muster. Fencing material has also been dropped into inaccessible areas, saving much time and labour.

Finally, and not entirely separated from the rural scene, is the aerial seeding of clouds in rain making experiments, and the very important work of the aerial ambulance and flying doctor services in country areas.

The increasing use of aircraft in agriculture has determined a need for a landing site—the agricultural airstrip.

An Authorised Agricultural Landing Area may only be used by a pilot with

The landing area is smooth and well covered and the edge of the strip is clearly marked by painted tyres.

an agricultural rating. The conventional Authorised Landing Area, which is of a higher standard than the agricultural type, is essential for charter or private operations, for example, stock buying or property inspection.

In the development period of aerial agriculture little emphasis was placed on airstrip selection. If the site was 300 to 400 yards long, reasonably level and free of large stones and stumps it was considered suitable. Now, expensive modern aircraft operate on rural work, and high costs, with increased competition between agricultural air companies, has created a need for safe and suitable landing areas.

In many districts the selection of a property airstrip does not pose a problem. However, on undulating and hilly country, where the aeroplane has most use, the selection of an airstrip needs careful consideration.

In selecting an airstrip site the practical working points and the Commonwealth Department of Civil Aviation legal requirements should be considered.

Practical considerations

The basic points in selecting an agricultural airstrip are that it be safe, efficient and be designed to minimise aircraft maintenance.

No special area is required for an airstrip. However, if in a grazing paddock all stock should be moved when the strip is in use.

For topdressing work the site should be as central as possible or facing the majority of the work area. The highest possible site is an advantage. If available these factors can reduce topdressing costs. This is because, normally, a surcharge is added to the standard tonnage charge if the treated area is over 2 miles from the airstrip or requires climbs above 500 feet from same.

The area selected needs to be well drained, particularly on the landing area, dump and loading sites. A good access road is essential, more especially for topdressing work, as heavily laden trucks will deliver bulk fertilizer to the airstrip for spreading. Gates leading to an airstrip need to be at least 10 feet wide, and any culverts or creek crossings should be checked for easy access. The dump site for topdressing work needs to be smooth and large enough for the anticipated tonnage of fertilizer. The area required is 30 feet wide by 1 foot long for each ton of fertilizer. For example, a 40-ton load would require 30 feet x 40 feet.

Few properties would have twin cross strips, especially in the rugged localities. Although twin cross strips do allow greater flexibility in varying wind conditions, they may not be practicable for topdressing operations where a fixed dump site is established. Two-way strips, that is, those from which an aircraft can land or take off from either end, are always desirable as they allow greater flexibility under varying conditions. However, most agricultural operations are carried out from single strips, where the aircraft may only land in one direction and take off in the opposite direction. The single strip should be made facing into the prevailing wind direction, which is most suitable for the aircraft to operate. Wind indicators will greatly assist pilots but they are not compulsory on agricultural airstrips. The approaches to the strip should not be blinded by high trees, as this could reduce the effective length of the landing area.

The removal of one or two trees could often correct this fault.

Power lines constitute a hazard and where possible a paddock crossed or bounded by power lines should be avoided. If this situation cannot be avoided the poles should be painted usually with orange and white alternating bands so they can be readily distinguished. In some cases light coloured insulated markers are threaded over power lines at spaced intervals to denote wire position.

The condition of the landing surface is covered by a regulation of the Department of Civil Aviation. It states, "The central 30 feet of the strip over its length shall be smooth; the 35 feet on either side of the central 30 feet shall be such that an aircraft running over it following a swing

on take-off or landing would not suffer damage. The remainder shall have no obstructions above ground level."

A reasonable test for smoothness of the central section is to drive a heavily sprung vehicle over the surface at 30 m.p.h. without discomfort to the occupants. Undulations are permitted provided they comply with the regulation. The central strip of the airstrip should not be dusty or gravelly. Ideally, a good pasture sward should cover the site. This can be mown or kept close grazed provided stock are removed when the airstrip is in use. The site should be checked before use, and gutters and stock tracks, for example, should be repaired. The whole area should be covered, and sharp objects, including wire, should be removed. Heavy grading should be avoided when preparing sloping strips. This loose soil on a slope could create an erosion hazard. In some cases this is impossible to avoid and guttering may occur in the early stages. Some form of soil stabilising material such as bitumen could be investigated for the centre 30-foot strip. However, when an airstrip is used only once a year for a farm operation it could be an unwarranted expense. This strip area should be sown with pasture as soon as practicable. In areas that respond to fertilizer the site can be top-dressed heavily in the initial years. Besides creating a good pasture sward it will induce stock to graze the area, keeping it in serviceable condition.

Property identification and strip markings can be of assistance to aerial operators. In most cases pilots are given a map to the property, but painting the property name in 6-foot letters on a shed roof will simplify aerial identification. The access road leading to the airstrip could show the same. The landing area should also be clearly marked. This is usually done by painting worn tyres or plough discs with white paint and spacing them along the edge of the landing area. An unserviceable strip should be denoted by painting palings white, and making at least two crosses with them on the strip area.

Operator's approval

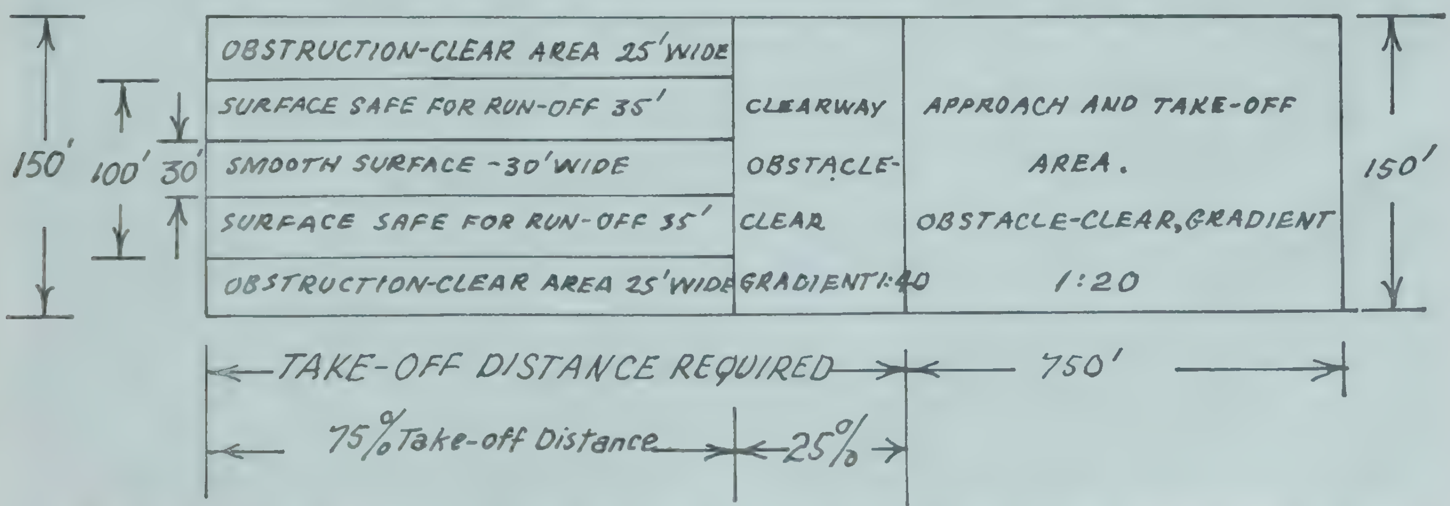
The aerial operator has the final say as to whether the airstrip is suitable for a particular purpose. Many aerial agriculture and fertilizer companies offer, free, a strip selection service to clients or prospective clients.

Regulations

The Commonwealth Department of Civil Aviation issues a set of regulations for guidance in selecting agricultural airstrips.

The general regulations are:

(*a*) Unless specifically approved by the Department of Civil Aviation, the area shall not be within 10 miles of a licensed aerodrome, military aerodrome or an aerodrome under the control or management of the Department of Civil Aviation unless the aerodrome is unserviceable, or is inaccessible to normal surface transport.



Gradients and dimensions of Authorised Agricultural Landing Areas as required by the Commonwealth Department of Civil Aviation.

(*b*) The area shall so be situated that operations at the area shall not involve flights at an altitude of less than 1,500 feet over a city, town or populous area.

(*c*) The area shall not be used without the owner's consent.

(*d*) The area shall consist of one or more strips which meet the physical requirements set down by the Department of Civil Aviation for authorised agricultural landing areas.

(*e*) Adequate precautions shall be taken to ensure that persons, objects and animals are kept clear of strips during landings and take-offs and clear of aircraft on the ground, with engines operating.

(*f*) The pilot in command before using a landing area shall take all reasonable steps to ensure that the physical dimensions and characteristics specified are met in full.

(*g*) The pilot in command shall take all reasonable steps to ensure that the surface of the strip is suitable prior to each landing and take-off.

Physical requirements for airstrips

The following provisions made by the Department of Civil Aviation are for aircraft having a maximum take-off weight not exceeding 12,500 lb. engaged in agricultural operations. This would cover the normal type of aircraft at present in use in New South Wales.

(*a*) Width and approach areas

Strip width, approach gradients, clearway and approach, and take-off area dimensions are to be as indicated in the diagram on page 69.

(*b*) Grades

Longitudinal gradient.—The maximum overall longitudinal gradient shall be 1:8. Where the overall longitudinal gradient exceeds 1:50 one-way operations only are permitted (i.e. down-hill take-off and up-hill landing).

Transverse gradient.—The maximum transverse gradient in the centre 30 feet of the strip shall be 1:33; in the 35 feet on either side of the central 30 feet it shall be 1:20, and over the remainder of the strip it shall be 1:8.

(*c*) Surface

This is covered earlier in the article.

(*d*) Length

The strip length is covered by regulation and is directly related to the approved length specified in the aircraft flight manual or approved performance charts as being necessary for take-off and landing. This chart places aircraft into various categories. The most commonly used aeroplanes for topdressing work are the Cessna 182 and the Beaver. These planes require a strip 1,500 feet long plus 150 feet increase for each 1,000 feet the strip is above sea level. In determining the effective length it is acceptable for the final 25 per cent. of the take-off distance required to be "clearway". Clearway is an area in which there are no obstructions above the slope of 1:40 measured from the end of the prepared surface over a width of 150 feet. This and the obstacle clear gradient is indicated on the diagram.

Costs

The cost of building an airstrip varies with the area. On some properties it will entail only a mowing of the area, some stone picking and painting of tyres. On rugged locations the preparation may entail some clearing and grading of land, and costs will vary. In cases where a relatively high cost is involved, neighbouring landholders could share the expenditure in a group effort to their own advantage.

Before any construction commences the landholder is advised to have the proposed site inspected by a Class 1 rated agricultural pilot for its suitability.

REFERENCE

Specifications for Authorised Agricultural Landing Areas, Section AGA4 of Aeronautical Information Publications, Department of Civil Aviation.

ANHYDROUS AMMONIA
A New Nitrogenous Fertilizer

R. D. MACADAM AND J. B. NOONAN

A NOW FAMILIAR SIGHT in the Manning River area and also in central-western districts and north coast sugar cane areas are anhydrous ammonia applicators. These modern farm implements restore soil fertility by injecting gaseous ammonia into the nitrogen-hungry soil.

What is anhydrous ammonia?

Everyone is familiar with ammonia gas as the sharp, pungent fumes given off by household ammonia solution. This bottled liquid is 5 per cent ammonia in a soap and water solution. Anhydrous ammonia is

The Authors: Mr. R. D. Macadam, Research Agronomist, Department of Agriculture, Taree, and Mr. J. B. Noonan, District Agronomist, Department of Agriculture, Taree.

Anhydrous ammonia road tanker

Country storage depot for ammonia.

pure, 100 per cent ammonia. "Anhydrous" means "without water". Pure ammonia is a chemical compound with the formula NH_3, that is, one atom of nitrogen combined with three of hydrogen. An atom of nitrogen weighs fourteen times as much as an atom of hydrogen, thus fourteen seventeenths of the total weight of anhydrous ammonia, or 82 per cent, is nitrogen.

Anhydrous ammonia is stored and transported as a liquid by keeping it under pressure in special containers.

If liquid ammonia is released into the atmosphere it rapidly expands into a gas which appears as a dense white vapour. It is slightly heavier than air. One gallon of the liquid expands to 113 cu. ft. of vapour. Ammonia is extremely soluble in water, rapidly dissolving to form a solution known as aqua ammonia. This also may be used as a fertilizer, the commercial form containing 20.5 per cent nitrogen. Aqua ammonia can be handled in low pressure equipment and does not need to be applied as deeply as anhydrous ammonia.

Soil application of anhydrous ammonia takes advantage of the rapid expansion of the liquid to a gas and its high affinity for water. The liquid in practical use is flowed down into the soil where it is released at a depth of about six inches.

On release the ammonia rapidly expands to a gas, spreads out in the soil and dissolves immediately in the soil moisture. It then combines with organic matter and clay particles, to be retained until utilised or changed by further soil processes.

Usage overseas

One of the most spectacular developments in American agriculture since the end of World War II has been the rapid rate at which anhydrous ammonia usage has increased.

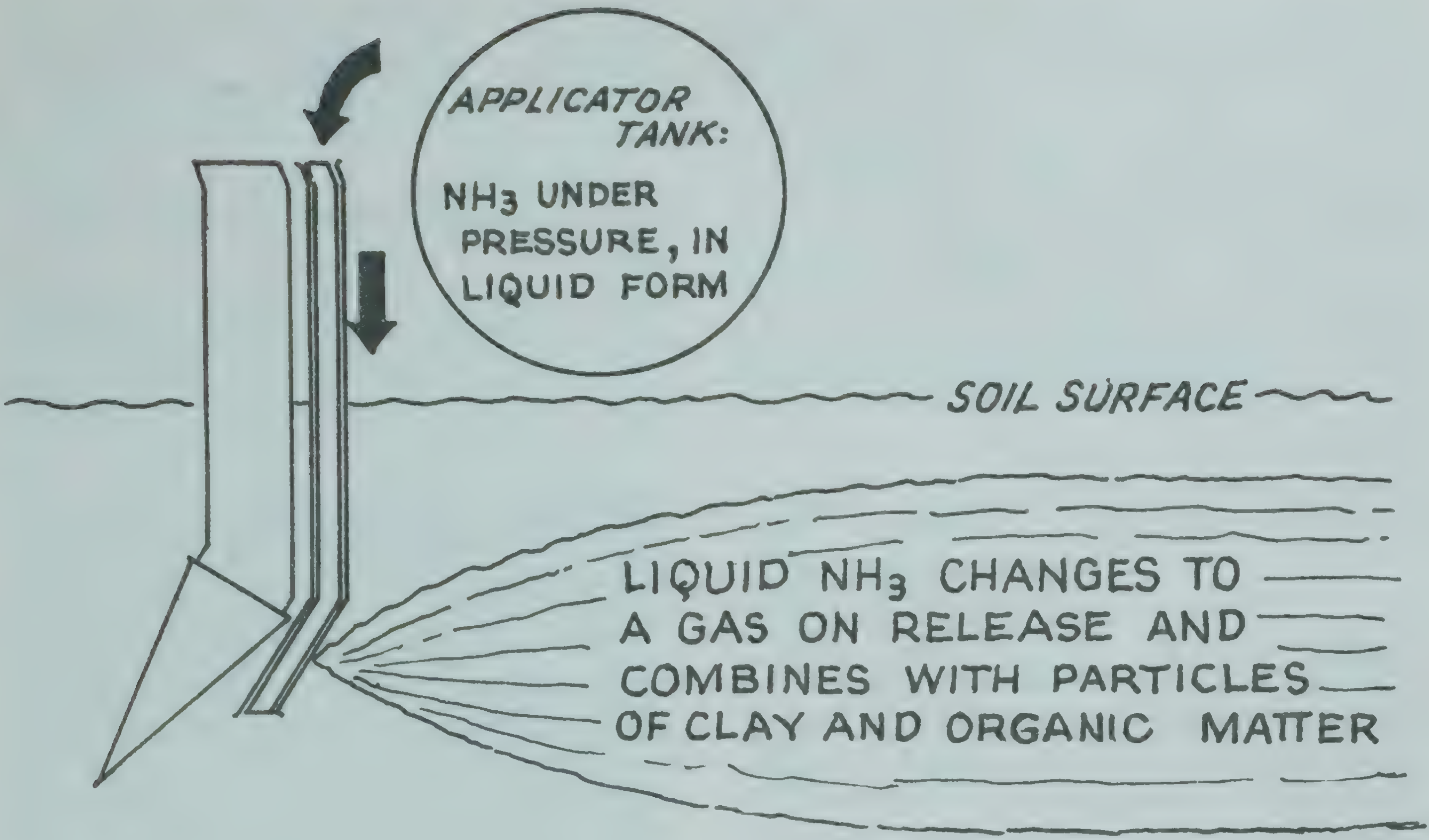
During World War II the United States Government had erected a large number of ammonia plants to supply the war effort. These plants were subsequently sold or leased to private enterprise.

Research workers at Mississippi State College carried out extensive research on direct injection of anhydrous ammonia into the soil. Their favourable findings were published in 1947. Consumption has increased from 20,000 in 1947 to 800,000 tons in 1961. In 1961 anhydrous ammonia accounted for over 40 per cent of all nitrogenous fertilizer used in U.S.A. There are now over eighty multi-million-dollar ammonia plants in the United States. Large expansion of production and consumption is projected for the future.

Method of application

The equipment needed for direct soil application of anhydrous ammonia consists of a nurse tank with a supply of ammonia, an ammonia applicator, a filling hose assembly to fill the applicator from the nurse tank, and a tractor to pull the applicator.

Nurse tanks are used to deliver ammonia to the field where an application is to be made. They are also called field supply tanks. These tanks are 500 to 1,000 gallons in capacity.



A typical applicator consists of a frame, a tank, applicator knives, hoses, flow regulators, valves, and a distribution manifold to divide the ammonia flow evenly among the hoses. One hundred gallons is the usual capacity of an applicator tank.

The tank is mounted on a frame which can be raised or lowered by the tractor driver so that the ammonia is applied at the required depth. The conventional applicator cuts a relatively smooth gash through the soil. This gash is about half an inch wide and usually from 4in. to 6 in. deep depending on the purpose for which the fertilizer is being used. The distance between the applicator knives can be adjusted for different crops.

Advantages

Anhydrous ammonia contains the highest proportion of nitrogen of any fertilizer —82 per cent. There is thus less dead weight to transport and apply.

Ammonia combines readily with clay and organic matter in the soil to resist leaching and restrict loss. Because it is applied down in the soil there is little loss to the air, and no fear of blowing or washing from the surface.

A farmer does not have to maintain his own anhydrous ammonia storage. Nor does he have the risk of caked or broken bags of fertilizer.

Suppliers also apply the ammonia (custom application). This means that the farmer need not invest his own capital in equipment, and those with small properties need not own machinery for infrequent use.

Ammonia requires no moisture or tillage to carry it down into the root zone, because it is applied there originally. Applied at that depth, it does not encourage growth of shallow-rooted weeds.

Ammonia has only a slight effect on soil acidity.

Disadvantages

The considerable capital outlay required to purchase equipment restricts farmers treating small acreages to custom application by the fertilizer company or agent. Unless service to the farmer is kept at a high standard the fertilizer may not be available when required.

Anhydrous ammonia, because it is a gas stored as a liquid under high pressure, must be handled by trained operators to ensure that serious accidents do not occur.

With the equipment at present available in N.S.W., anhydrous ammonia can only be applied to a prepared seed-bed. For such operations as top-dressing and sod-seeding the farmer must still use solid nitrogenous fertilizers.

Anhydrous ammonia cannot be applied if the soil is too moist. The soil will not fall in behind the knives and seal the gas in the soil, and so losses to the air may result.

Comparison of prices of nitrogenous fertilizer

Fertilizer	Cost per ton	Per cent nitrogen	Cost lb. of N
Sulphate of ammonia	£29	20.5%	1/3
Calcium ammonium nitrate	£39	20.5%	1/8⅓
Urea	£52	46%	1/0
Anhydrous ammonia	—	82%	1/1

Prices quoted are ex works or ex wharf. Prices are as on 20 July, 1964. In addition to the cost of 1/1 per lb. of nitrogen for anhydrous ammonia there is an application fee of 30/- per acre.

Usage in the Manning District

Anhydrous ammonia was first used commercially for agricultural purposes in the Manning district in the autumn of 1962. It is understood that this was the first commercial application of the fertilizer in Australia.

One thousand four hundred acres of winter pasture and forage crops were fertilized with ammonia in the autumn—early winter period of 1962. Approximately 30 tons was used. The most common application rate was 60 lb. of nitrogen per acre, equivalent to the nitrogen in about 300 lb. of sulphate of ammonia.

Twenty five tons was applied the following spring and summer. Maize, sorghum and French beans were the principal crops fertilized.

The year 1963 was extremely wet and consumption fell from 55 tons in 1962 to 30 tons in 1963 as a result. Autumn 1964 was a favourable season and 30 tons was used on winter pastures and forage crops.

Ammonia has also been used at Gloucester (80 acres in 1963) and Glen Innes, where some hundreds of acres of maize

Ammonia being transferred from a nurse tanker (right) to an applicator in the field

were side-dressed in 1963. Large-scale applications were also made to cotton, sugar and wheat during 1963 and 1964.

Results

The summer, autumn and early winter of 1962 were very wet. As a result, heavy leaching of nitrogen had occurred from most soils in the Manning and adjacent areas. With the pressing need for large quantities of quality forage for milk production the stage was set for a wide-scale trial of nitrogenous fertilizer to make up the deficiency.

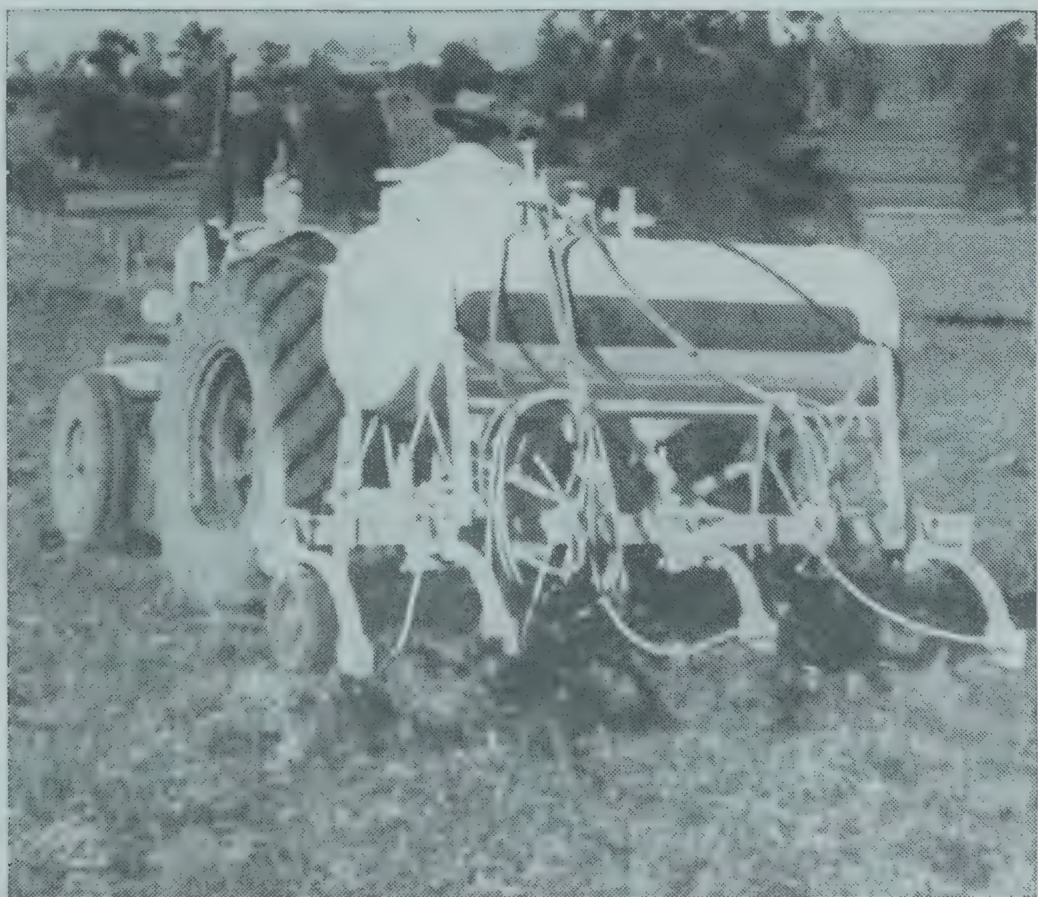
A variable-orifice type ammonia flow regulator with built-in dial charts, quick shut-off valve and distributor manifold. Pressure gauge is helpful in determining malfunctions.

Anhydrous ammonia was applied prior to the sowing of the winter pasture mixtures and cereal forage crops. Rates varied from 40 to 100 lb. of nitrogen per acre.

Generally the responses were good. The growth on treated areas was vigorous and green, whereas untreated pastures and forage crops developed slowly and were often of a pale green to yellowish colour with a high incidence of rust.

Results with pasture

The response in sown rye grass pastures was striking in many cases. One such example was on the property of Mr. K. Campbell at Dingo Creek. A second class soil overrun with carpet grass was cultivated and given a short fallow. The area was liberally supplied with superphosphate prior to sowing. Two strips of anhydrous ammonia were run across the paddock, one at 60 lb. nitrogen per acre, the other at 80 lb. nitrogen per acre. There were nil nitrogen areas between and on either side of these strips.



Anhydrous ammonia being injected into the soil.

The area was harvested on 28th June, 1962. The yields per acre, together with a valuation of the dried feed, were:

Treatment	Dry matter yield per acre	Extra cost	Value of extra feed
Nil nitrogen ..	1,100 lb.		
60 lb. nitrogen ..	2,570 lb.	£5 5 0	£18 per acre
80 lb. nitrogen ..	3,100 lb.	£7 0 0	£26 per acre

The dried fodder would have contained at least 15 per cent crude protein and been comparable to concentrates, hence the price of concentrates was taken as the value of the feed per ton.

The striking response to ammonia impressed most farmers, but in some cases the results were erratic. The ammonia did not give lasting effects in some instances. Mr. J. Weekes of Hillville obtained outstanding results on ryegrass where 60 lb. of nitrogen per acre was applied, but after one grazing the paddock lost its vigour and was of poor colour. The grazing of Mr. K. Campbell's paddock was delayed somewhat but there also the regrowth was disappointing.

In most cases where 100 lb. of nitrogen per acre was applied the period of response was very much longer, and superior regrowth was apparent even at the third grazing.

Possible adverse factors, particularly in the lack of persistent response; were:

—Rate of application too low to give a long-lasting effect, most of the nitrogen being used up in the first growth; 100 lb. of nitrogen per acre has been suggested as the minimum level for pastures and winter forages;

—Applicators were faulty and at times gas escaped from the soil;

—Operators were inexperienced; and

—Heavy rains and over-wetness caused more leaching than is usual in the U.S.A.

Results with maize

Response to the fertilizer varied when anhydrous ammonia was applied to maize, but most farmers reported excellent results with this crop. In 1963-4 two fields were sampled where ammonia had been applied; as might be expected, the response depended largely on the existing nitrogen level of the soil.

Alluvial soil. Messrs. L. J. Ballard and W. Yarnold, Dingo Creek, Wingham.

Maize was grown on this land in 1962-3 and the area was then worked up well and sown again to maize in early November 1963. Prior to sowing anhydrous ammonia was applied in strips of nil, 60, 80 and 100 lb. of nitrogen per acre. Crop growth was very satisfactory in all plots.

At maturity the strips were carefully sampled for yield; there was no difference between the treatments. The average yield was 100 bushels per acre. Yield had been depressed somewhat by the hot, dry weather in January.

In the previous year some side-dressing trials with ammonia were carried out on maize in this same paddock, but again there had been no significant response.

Old red soil. D. K. Hammond, Langley Vale.

One and a half acres of a twenty acre paddock sown in early November 1963 was side-dressed with 80 lb. of nitrogen per acre when the crop was 12in. to 15in. high. The basal fertilizer at sowing was 200 lb. of a complete fertilizer (4 per cent nitrogen, 16 per cent phosphate and 4.5 per cent potash).

The crop was sampled at harvest with the following results:

No anhydrous ammonia, 84 bushels per acre;

Anhydrous ammonia at 80 lb. nitrogen per acre, 109 bushels per acre.

The additional 25 bushels per acre, worth approximately £15 as grain, was secured at an additional fertilizer cost of £5 10 0 per acre.

These results show that anhydrous ammonia is a satisfactory source of nitrogen for maize and should give good yield increases on land where the nitrogen level is not high, when:

—The crop is adequately supplied with moisture and other nutrients;

—The land is correctly prepared and sown with high yielding hybrid seed; and

—There are enough plants per acre to ensure maximum use of the nitrogen.

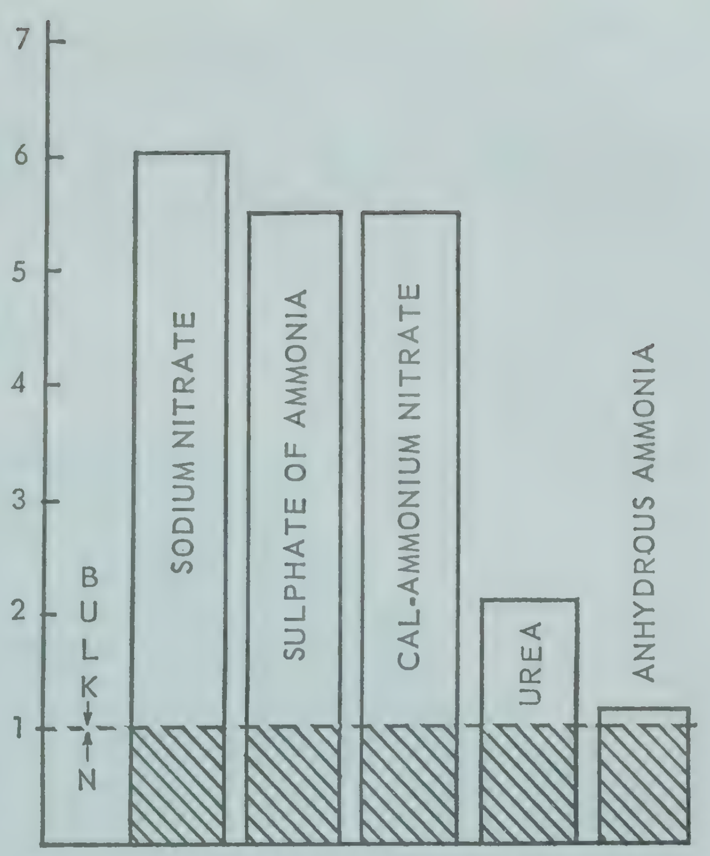
Other crops

Sweet sorghum has responded well to the application of ammonia. Many sorghum crops are obviously deficient in nitrogen, as evidenced by the poor and patchy growth, and poor colour.

Ammonia was tried by several farmers in the Wingham-Taree area who grew stringless beans under contract to processing firms. In one case a trial of several rates was laid down. The soil was a good alluvial, and with this short-term crop yield increases were not substantial.

Conclusion

Nitrogenous fertilizers have been used increasingly for crops and pastures in the Taree district. Overall there is evidence of the need for greater use of nitrogen and the inclination of farmers is to apply more, and to larger areas.



LB. OF MATERIAL FOR
ONE POUND OF NITROGEN

Results with anhydrous ammonia have, in the main been very good.

Anhydrous ammonia offers the farmer a proposition that is favourably priced per pound of nitrogen although he must pay for the service, it is applied to the soil for the farmer without use of his labour or equipment; and it is located in the moist area of root growth where it can be most efficiently used. ●

Incorrect Branding Impairs Apple Exports

Incorrect branding and poor case-marking of apples submitted for export is avoidable and costly. In the long run the producer bears these expenses.

Shipside rejection because of faulty brands, and case marks makes no one happy, least of all the inspectors who have the responsibility of enforcing the export regulations.

Correct case marks and brands make sorting easy and eliminate confusion at oversea ports. The standard procedure for case branding should be adhered to strictly.

Growers not familiar with export apple branding regulations should contact their local Departmental fruit officer or fruit inspector for details. ●

THE MACADAMIA—

Australia's Own Nut

The macadamia makes a good shade tree, as well as producing nuts. This *macadamia tetraphylla* tree growing near Mullumbimby is reputed to be the largest macadamia tree in Australia. It is 40 ft. wide, 30 ft. high, and has produced 300 lb. of nuts in one season.

THE MACADAMIA NUT (*Macadamia integrifolia* and *M. tetraphylla*) is indigenous to the coastal parts of north-eastern New South Wales and southern Queensland. It is sometimes known as the bush nut, Australian nut, or Queensland nut. It is the only native Australian plant which has ever been developed as a commercial food crop.

It is a highly nutritious nut food, being the richest oil-yielding nut known, producing about 76 per cent of oil equal in quality to the best olive oil. The nut, however, is too valuable to be used for the extraction of oil. The shell of the nut contains about 2.8 per cent of oil and the hulls, that is, the green coverings of the nuts, contain approximately 14 per cent of substances suitable for tanning leather. In Australia no commercial use has been made of the hulls for tanning.

H. J. CANN

The Macadamia nut is regarded as one of the best edible nuts in the world. It may be eaten raw, it is delicious when cooked and salted, makes a nice nut paste and can be used in cakes and confectionery.

Its cultivation is extending steadily. If given proper attention there appears to be no reason why this nut should not play a valuable part in the development of the nut industry in this State and Queensland.

In Hawaii, the Macadamia industry has been developed from a few seeds imported from Australia about 1892 into a well-established and important industry.

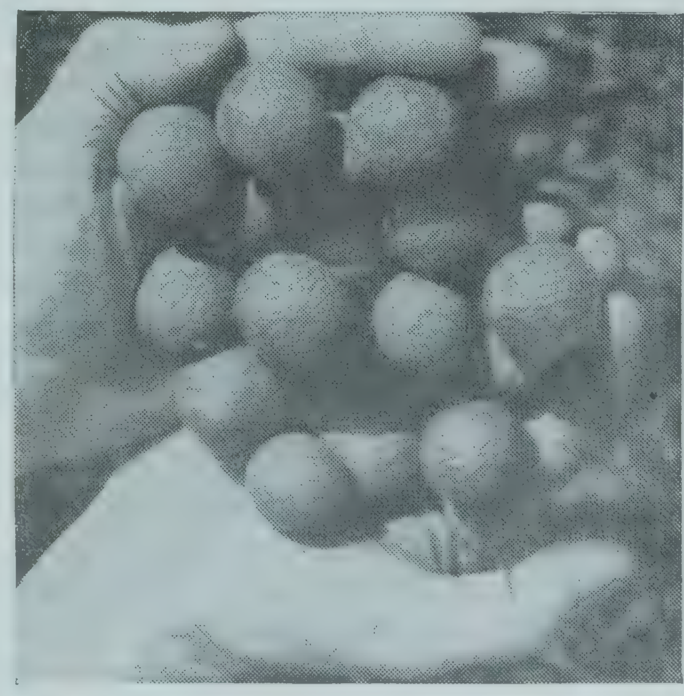
Large areas could be planted with the Macadamia nut in the north-eastern coastal areas of this State, but so far large-scale plantings are few. This nut tree provides an opportunity for establishing permanent orchards which would give an annual income for many years.

As macadamia nuts ripen, the husks split and the nuts fall to the ground.

Conditions suiting the Macadamia

The Macadamia thrives best in the semi-tropics, and being a rain forest tree, requires considerable moisture. Cropping is adversely affected by lack of moisture; yields are generally poor in dry seasons as only about half the normal crop, in size, quantity and quality, is produced. Good rains in spring and early summer are necessary for a good setting of nuts. Obviously, irrigation would be very valuable for this tree in dry times.

A position sheltered from prevailing winds is essential; trees are susceptible to damage by heavy winds, those growing in the open



Macadamia tetraphylla **nuts have a pebbled look.**

The Author: Mr. H. J. Cann, Special Fruit Officer (Tropical Fruits), Department of Agriculture, Murwillumbah.

Flowers of *Macadamia integrifolia.*

generally failing to produce well on the windy side. Young trees should be protected from wind damage by staking and bagging. Although light frosts do not appear to damage this tree, it is better to avoid sites liable to frosts.

The Macadamia will grow in a wide range of soils if the drainage is good. Only where the soil is loose sand, stiff clay or is very rocky, does the tree fail to grow. Being a rain forest tree, it naturally thrives best in deep, friable, fertile loams and it is therefore advisable to plant it in such soils.

Selection of seed

Seed for propagating should be selected only from trees which have shown desirable characteristics. These are vigorous and thrifty growth, regular and heavy bearing, well-filled and uniformly shaped nuts, freedom from diseases and earliness in reaching commercial bearing. Nuts containing loose kernels and those of hemispherical shape should be discarded, as they are undesirable and do not germinate as satisfactorily as solid kernel nuts.

Raising seedlings

Propagation of the Macadamia nut from seed is not difficult. Seed-beds, tins or boxes should be made up with good garden soil. A satisfactory mixture is half of leaf mould and half of sand. Seed nuts, fully matured, are best planted soon after picking, as undue delay in planting may affect their vitality. Autumn planting (March to May) with new season's seed will give good germination. If the nuts are kept for spring planting they should be stratified in moist sand after harvesting and kept at a low temperature and in a dark place until planted.

The nuts are planted in their shells. They are placed about 6 inches apart each way on top of the soil, and covered with about an inch of mulch of leaves or rotten farmyard manure. Liberal waterings for the first week or so after planting are necessary so that the shells can absorb enough moisture to open freely in germination. If the seed-beds are watered two or three times a week the seedlings may begin to appear in three or four weeks time. Thick-shelled nuts take longer to germinate than thin-shelled nuts. Germination can be assisted by soaking the nuts in water before planting.

Vegetative propagation

Until recent years grafting Macadamia trees was not very successful in Australia. In Hawaii a thriving Macadamia nut industry has been established, mainly because nurserymen have been able to graft high yielding varieties suitable for processing. Because of this, it has been possible to produce crops of uniform nuts under orchard conditions and so produce a standardised product.

This is in direct contrast to the conditions which have, until recently, existed in Australia. Here, nuts have only been obtainable from seedling trees grown under very varying conditions and producing a great variety of nuts. This variation of nut quality has prevented a standard product being produced and has been one of the main reasons why the Macadamia nut industry has not forged ahead.

Under New South Wales conditions it is not easy to graft Macadamias. However, more success has been obtained in the last few years than previously. Some nurseries in Queensland are selling grafted trees but at present they are in short supply and are costly. A survey of Macadamia trees in New South Wales and Queensland has revealed a number of trees of good vigour which produce good crops of excellent

quality nuts. Grafting material from these trees has been propagated on to seedling stocks and planted out for observation and in commercial orchards. It is confidently expected that in a few years larger supplies of grafted trees will be available. As these come into production the industry should be able to expand and produce a top grade article for which there is a great demand.

Transplanting

Transplanting needs care and is best done when the trees are making least growth—during the late autumn and winter months. Showery weather should be chosen for this operation.

Pot-grown trees are preferable as they present the least difficulty in transplanting. Trees should be removed from the containers with little disturbance to the root system. Pot-grown trees can be put out without undue risk of failures, even though the trees are in active growth at times of the year when weather conditions are most favourable, such as during the rainy months of January to April.

There is a greater risk of losses when transplanting direct from seed-beds. Trees in seed-beds should be watered liberally before being lifted. They should be removed with as much soil and as many roots as possible, and kept wrapped in moist sacking until planted, as a protection against sun and wind.

When transplanting, firm the soil well around the seedlings, water them liberally and then mulch the soil surface. Shade the trees until they have struck properly and support them against the prevailing wind by tying to stakes. If necessary, water the trees freely until they begin to grow well.

Seedlings from 6 to 12 months old, or from 6 to 12 inches high, transplant satisfactorily and they do better if put out when small.

Planting distances

Planting distances depend on soil conditions and the variety to be planted. Varieties having a tendency to grow upright can be planted closer than those with spreading habits. In the less rich soils, trees can be planted closer and in good soils, wider apart. In poor soils, trees of upright growth might be planted as close as 20 feet apart each way. From 24 to 30 feet on the square is necessary for average soils and varieties.

It may be economical to plant trees closer and cut some out as they develop to a size where the trees start to touch each other. Trees planted originally 24 feet x 15 feet could have alternate trees destroyed and eventually become a 24 x 30 feet orchard. If trees are planted too closely they do not bear heavy crops and the control of insect pests becomes very difficult.

Cultivation

The Macadamia tree responds to cultivation, care and attention. Unless the land is kept free of weeds, young trees are checked and their growth is slow.

Controlling weeds is the main consideration as the trees grow. This can be done with implements or by spraying with a weedicide, but care must be taken to keep

Suggested fertilizer applications per year for macadamia trees

Trunk diameter (inches)	Before peak bloom	Summer application		Autumn application		Total application per year
	ammonium sulphate amount	mixed fertilizer amount	Formula (NPK)	mixed fertilizer amount	Formula (NPK)	Pounds
3	12 oz.	1 lb. 2 oz.	10-10-10	1 lb. 2 oz.	10-10-10	3
6	1 lb. 8 oz.	2 lb. 4 oz.	10-10-15	2 lb. 4 oz.	10-10-15	6
9	2 lb. 4 oz.	3 lb. 6 oz.	10-10-15	3 lb. 6 oz.	10-10-15	9
12	3 lb.	4 lb. 8 oz.	10-10-15	4 lb. 8 oz.	10-10-15	12
15	3 lb. 12 oz.	5 lb. 10 oz.	10-10-15	5 lb. 10 oz.	10-10-15	15

weedicides from contacting the trees, especially the smaller ones. Keeping the weeds down and the ground raked of leaves enables harvesting to be done easily and quickly. Spraying with weedicides should not be done when nuts are on the ground as the nuts may absorb the odour of the weedicide and become unfit for human consumption.

Young trees need to be fertilized to keep them growing. The faster the young trees grow the faster they come into bearing. Three or four small applications of a complete fertilizer with an NPK ratio of about 10:10:10 should be made to young trees each year. The fertilizer should be broadcast over the root area and not close to the trunk. A total of approximately 1 lb. should be applied the first year and about 2 lb. the second year.

There is very little experimental evidence of the fertilizer requirements of Macadamia trees. However, the table on page 81 will give an idea of the requirements of trees and could be used as a basis from which to work.

A dual-purpose tree

The Macadamia nut makes an excellent evergreen shade tree. It is ornamental and of good symmetrical shape. Farmers contemplating planting trees for shade and shelter for stock, or for beautifying the farm landscape, should consider planting the Macadamia, as indigenous trees usually do better than others.

Varieties

There are two commercial species of Macadamia, namely *M. tetraphylla* and *M. integrifolia.*

M. tetraphylla, having spiny leaves through all stages of growth and producing an annual crop of rough-shelled nuts was, until recently, known as *M. ternifolia* in this country. It has now been correctly classified as *M. tetraphylla. M. ternifolia* now is a non-edible nut occurring in Queensland. The second species, having smooth leaves after passing through the early seedling stages and producing smooth-shelled nuts over most of the year from two main blossom periods, has been named *M. integrifolia.*

Blossoming and harvesting

The flowers of the Macadamia nut are produced in long, narrow drooping racemes up to 12 inches in length. They appear profusely in the spring (August to October), and are creamy white and pinkish in colour. The nuts from this blossoming are ripe from January to May, but March and April are the main harvesting months.

Macadamia integrifolia, called the "everbearing" type, carries blossoms and nuts in different stages practically all the year round. It has two more or less distinct crops with intermediate ones depending on the season. To produce two distinct crops a year, a good

Contrasting characteristics of *M. tetraphylla* and *M. integrifolia*

	M. tetraphylla (Rough-shell type)	*M. integrifolia* (Smooth-shell type)
Nuts	Usually slightly elliptical or spindle-shaped. Surface pebbled.	Round or very nearly round. Surface smooth or nearly so.
Mature leaves ...	Commonly four leaves at a node but rarely three or five; young seedlings have two; leaves usually larger and longer than *M. integrifolia;* leaf sessile or stems with very short petioles, leaf margins serrate with many spines along the edges; leaves up to 20 inches in length.	Three leaves at a node (except for young seedlings which have two), leaves usually shorter than *M. tetraphylla,* ranging from 4 to 12 inches in length. Leaf stems usually about ½ inch long. Leaf margins on mature trees are much less spiny than *M. tetraphylla* and often without spines.
Young leaves ..	Purple or reddish in colour.	Pale green or bronze.
Flower colour ..	Pink.	Creamy white.

season with plenty of rain and no shortage of soil mosture is necessary. The main blossoming appears about September and October, and the nuts ripen in the autumn—about March to May. This is the main crop and generally the heaviest one. The trees may then blossom again about March, and ripen a crop in the spring. The nuts take approximately six months to mature from time of blossoming.

When the Macadamia nuts are mature the thick outer husks split and the nut falls from the tree. They are then harvested by picking them off the ground. Sometimes the splitting husk and the nut inside both fall from the tree. These nuts are ripe and should be harvested. Picking from the tree is not very successful as many immature nuts which are not suitable for processing are harvested.

Nuts should be picked up at least every two weeks as if left on the ground they soon begin to rot, mould or germinate. Rat damage can also become a problem. After picking, the nuts should be spread out to dry before being sold.

Yields

As with all trees, it is hard to give an estimate of yields as so much depends on the season and the man.

The Macadamia starts to bear when 6 or 7 years old. It will then have a few nuts. When 8 to 10 years old it should bear 10 to 30 lb. and from 12 to 14 years old, to 60 lb. of nuts.

Aged trees have been known to yield more than this in good seasons and instances of 250 lb. from one tree are known.

In 1932 it was recorded that 26 trees, then 45 years old, produced 1,625 lb. nuts. These trees were planted 28 to 30 feet apart and were then just touching each other.

A good yield can only be obtained if trees receive good culture and are kept free of diseases and pests.

Diseases and pests

So far the Macadamia is not subject to any serious disease, but there are a few insect pests capable of causing serious damage.

Spraying should not be done indiscriminately. There are many beneficial insects which keep harmful insects in control and spraying when not really necessary can cause a rapid build-up of species which are normally controlled by natural means. Spraying is best confined to trees or parts of trees actually infested. Wasteful and harmful over-all spraying should be avoided.

The fruit spotting bug (*Amblypelta nitida*) is a pale yellowish-green, flat bug which attacks the young developing nuts soon after setting, and causes immediate shedding of many nuts. Its worse effect, however, is the malformation of kernels.

The fruit spotting bug is very hard to detect on macadamia trees and usually the first indication of its having been active is the malformation and brown spotting of the kernels when the nuts are cracked.

Fruit spotting bugs are not pests of all trees and it is neither necessary nor advisable to apply a preventive spray to all trees each year. However, if bug damage occurs then the following year a 0.1 per cent DDT spray should be applied to trees just before blossoming.

The Macadamia leaf miner (*Acrocercops chionosema*) is a moth whose larvae mine and blister the upper surfaces of the leaves. Only very young tender leaves are attacked, hence damage occurs with each flush of growth in spring and summer. Trees of all stages of maturity may be attacked but the effects of leaf miner are usually severe only on young, non-bearing trees. Azinphos ethyl (Gusathion®) sprays at 0.05 per cent concentration applied at three-weekly intervals in spring and summer have effectively protected trees from damage in experiments conducted at Murwillumbah.

The Macadamia nut flower-eating caterpillar (*Homoeosoma vagella*) is bluish-grey, and about one inch long. It attacks the blossoms and can cause an almost total loss of crop. For control, spray with DDT before or during blossoming, as for the spotting bug.

® Registered trade name.

The Macadamia nut borer (*Arotrophora ambrodelta*) attacks the developing nut. The young, light yellowish-brown larvae enter the nut in its young stages and feed from the inside outwards. The damage is only detected as the nuts are approaching maturity, when the boring frass can be seen on the opening hulls and clusters of nuts. Examination will reveal a small hole in the shell and a completely spoiled kernel.

An early DDT spray should be used as for spotting bug, with follow-up DDT cover sprays during the early setting stages.

The twig girdler caterpillar (*Neodrepta luteotactella*) causes two types of damage. They destroy or web together considerable areas of young leaf surface, and they ring-bark twigs and small branches. They can cause severe check to the growth of young trees.

Spraying with 0.1 per cent DDT gives satisfactory control. Sprays should be applied in late April and October, and the production of new wood in summer may necessitate another application about December.

It must be realised that the Macadamia tree has dense foliage and the pests involved are difficult to reach, so that high pressure spray units are necessary. ●

A Standard for Concrete Fence Posts

THE Standards Association of Australia has published an Australian standard specification establishing minimum quality requirements for factory-made concrete fence posts and struts. The standard was prepared at the request of primary producer organizations, and was supported by grazing and manufacturing interests in all States.

Although applying to factory-made posts, both reinforced and pre-stressed types, the standard recognizes that many users of reinforced concrete posts prefer to make their own. Accordingly, the standard includes details of recommended dimensions and reinforcement for posts manufactured under field conditions. There is particular reference to concrete mix and minimum clear cover of concrete over reinforcement and ties. There are also recommendations for the erection and straining of fencing.

Since the standard is basically concerned with the performance of the posts, it includes particular requirements for materials and manufacture, and for impact and static-load testing. Methods of conducting the tests are described.

Two strengths of post and strut are recognised in the standard, designated as Class A, light duty (suitable for sheep), and Class B, heavy duty (suitable for cattle and horses). Minimum length and width are specified, and the wire spacings are given. Provision is made for wires to be fixed by use of cast-in metal projections or clips, holes in posts, or corrugations on one side of the posts.

Copies of the standard, which is designated "AS N36", are now available from the offices of the Standards Association of Australia in the State capital cities (Sydney: 157 Gloucester Street), and at Newcastle (14 Watt Street). The price is 8s. a copy, plus 5d. postage. ●

The 1964 Farrer Memorial Oration
A Summary—

The progress of Australian agriculture and the role of pastures in raising production

C. M. DONALD

THERE ARE VERY FEW COUNTRIES which have a complete history of their agriculture from the time it began. Australia is one of these countries, and it is of great interest to trace the ways in which our agriculture has progressed since European settlement in 1788. It also enables us to gain a clearer insight into probable developments in the future.

We can distinguish two ways in which we have attempted to improve our agriculture. Firstly, we have adapted our plants and animals and practices to the conditions we found in Australia; secondly we have actually changed the conditions for the growth of crops, pastures and stock, so that they are more favourable now than they were when Governor Phillip landed at Sydney Cove in 1788.

These two aspects of our agricultural progress can be illustrated by looking briefly at three periods in our history, 1788-1900, 1900-1930 and 1930-1964.

Our first century

In the first period to 1900 *we adapted* our agriculture to Australian conditions by bringing in many breeds of livestock, by developing the Australian Merino, by introducing a great variety of crop plants, and in various other ways, such as the development of stump jump implements. On the other hand, the *changes we made in the agricultural environment* during this period included clearing, fencing, watering points, ploughing, cultivation and irrigation. It would be satisfying if we could feel that in all these ways, throughout the nineteenth century, we had succeeded in improving the productive capacity of Australia, but this was not so. Many native pastures, especially in drier areas, were over-grazed, while in the cereal districts heavy cropping without the use of fertilizers led to a serious decline in wheat yields, from 12.8 bushels per acre in the 1870's to 7.3 bushels in the 1890's. (See figure 1.) Cereal soils were depleted

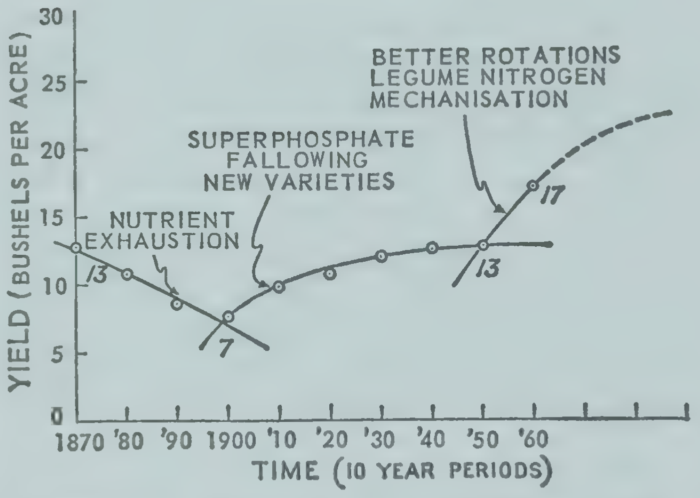


Figure 1.—The trend in Australian wheat yields (10-year averages) during the past century.

The Author: Professor C. M. Donald, Professor of Agriculture and Head of the Department of Agronomy, Waite Agricultural Research Institute, at the University of Adelaide. Farrer Medalist for 1964.

both of nitrogen and phosphorus. It can be said of our first hundred years that despite the great work of our pioneers in developing the Australian agricultural and pastoral industries, there was damage to our croplands and a reduction in the carrying capacity of extensive areas of pasture.

The years from 1900 to 1930

In the next period, 1900-1930 there was further *adaptation* to Australian conditions through the outstanding contribution of the wheat varieties of William Farrer, by the extended use of fallowing, through the growing use of pesticides and fungicides and by considerable progress in the control of animal disease. During this time we took a notable step towards *changing* the environment advantageously; this was by the use of superphosphate on the phosphorus deficient soils, characteristic of most of Australia's cereal areas. This was a real change, and a vitally important one, in the agricultural conditions for crop growth. We also made a beginning in the use of sown pastures, but with emphasis at that time only on the fodder production aspect, and with little realisation of its effect on soil fertility.

But during this period the bare fallow was seriously misused in many districts. It was thought that its value lay only in weed control and water conservation, but we now realise that what happens under bare fallow is to "burn up" some of the organic matter of the soil to give available nitrate for the next crop. In many districts throughout Australia this led to a serious loss of soil structure and to susceptibility to water and wind erosion. Though wheat yields rose from 1900 to 1920, they were falling again in parts of Australia by 1930. Further deterioration of our native pastures occurred in many areas. Thus this second period, 1900 to 1930, saw little real improvement of the Australian agricultural environment, and in many regions there was considerable further damage to both soil and vegetation.

The advent of improved pastures

The third period, 1930-1964, has ushered in remarkable change. While we have continued to adapt to Australian conditions by plant breeding, mechanical means of soil conservation, and mechanisation, we have also embarked on an impressive programme of changing the face of Australia through improved pastures.

Australia is a continent mostly of poor soils, a factor which has seriously limited our production. But the use of fertilized pastures which include legumes such as the clovers and medics, is changing poor soil to good soil. This transformation can even be compared with the reclamation of lands in Holland from beneath the Zuyder Zee. Though less spectacular, and fortunately less expensive, it is not only improving lands carrying native pastures, but is also enabling the conversion of what were worthless and unproductive soils into lands of satisfactory productivity.

The lift in soil fertility

A survey at Crookwell, New South Wales, showed that subterranean clover, which provides nitrogen through its root nodules, and superphosphate, which provides phosphorus and sulphur, have raised the organic matter and the nitrogen of the soil to three-fold the virgin level, with an increase from 0.06 per cent nitrogen to 0.18 per cent. Similarly, on a wheat farm in South Australia, the use of clover leys in the rotation has raised the soil nitrogen level by 50 per cent in six years.

This improvement in fertility, which is occurring on some forty million acres of soils, is reflected both in livestock numbers and in crop yields. During the period from 1947 to 1963, the sheep numbers rose from 95 to 160 million, an average increase of 3.3 per cent per annum, while the fleece weight increased by 0.7 per cent per annum. These two factors have together given an average annual increase of 4 per cent in our wool clip.

Stock numbers

Calculations show that of all the increase in cattle and sheep numbers in Australia from 1947 to 1963, half was attributable to pasture improvement alone. All other factors put together—myxomatosis, disease

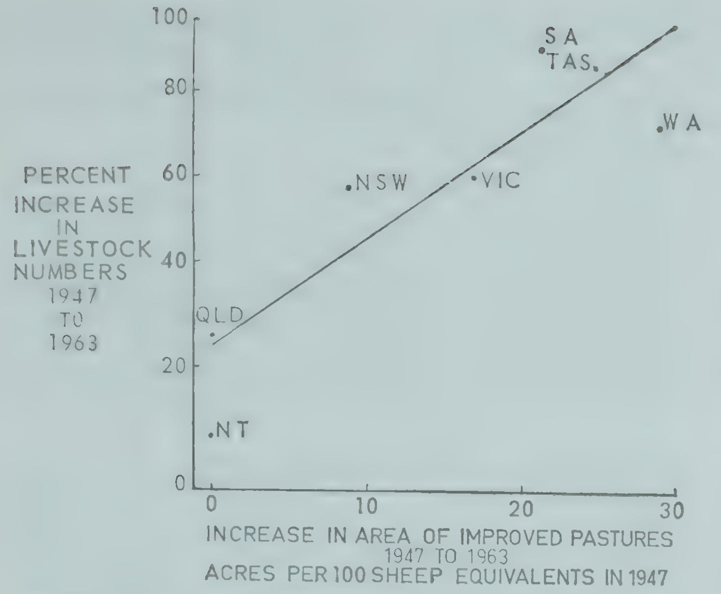


Figure 2.—The relationship between the increase in the area of improved pastures and the increase in livestock numbers (cattle x 7 plus sheep) in all Australian States from 1947 to 1963.

control, fodder conservation, fencing, watering, irrigation, improved transport and so on—were responsible for the other half of the increase. The States with pasture improvement (New South Wales, Victoria, South Australia, Western Australia and Tasmania) showed an increase in stock numbers from 1947 to 1963 of 63 per cent, while in Queensland and the Northern Territory, where pasture improvement is only now beginning, the increase was only 24 per cent. Figure 2 shows how the States with the most pasture improvement have shown the greatest increase in livestock numbers.

It is difficult to say how much of the increase occurring in Australian fleece weight is attributable to improved pastures, but certainly a good deal of it is. Sown pasture on the southern tablelands of New South Wales stocked at three times the rate of native pasture, gave a fleece weight of 11 lb. 4 oz. compared with a fleece of 10 lb. 3 oz. on the native pasture. In other instances the increase has been much greater. Thus sown pastures are not only giving a great increase in stock numbers but are also contributing to wool production per sheep. Figure 3 shows an analysis of these factors contributing to the increase in wool production since 1947.

Cereal yields

When we turn to the effect of this improvement in soil fertility on cereal yields the story is just as striking. The fallow-wheat, or fallow-wheat-oats or similar sorts

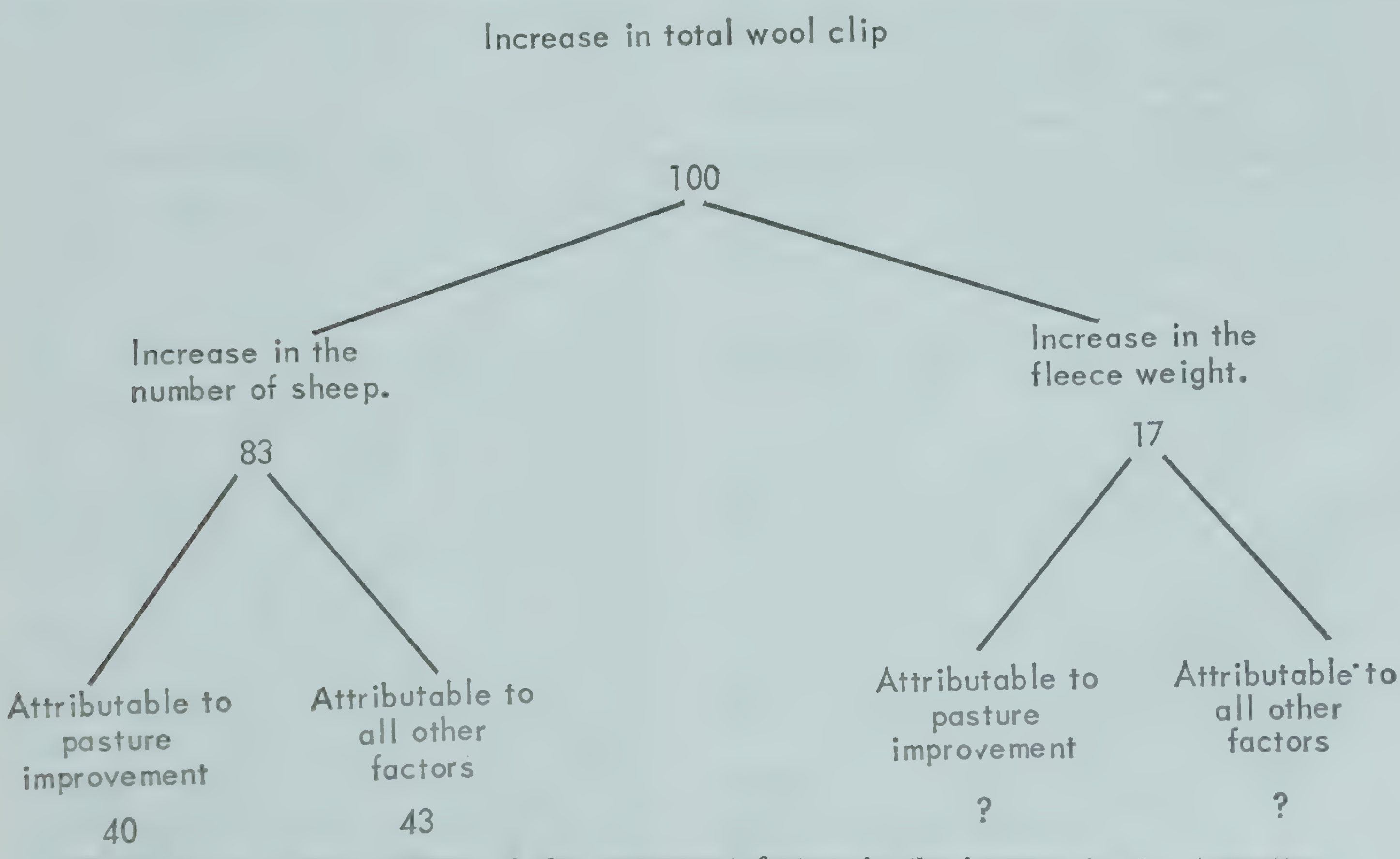


Figure 3.—A partial analysis of the component factors in the increase in the Australian wool clip, 1947 to 1963.

of rotations have been replaced over great areas by those which include both a pasture phase and cropping phase, the latter either with or without a fallow component. The effect on yields has been remarkable, with an increase in the average Australian wheat yields from 12.8 bushels per acre in the 1940's to 17.1 bushels in the 1950's. (See figure 1.)

A survey by the Wagga Agricultural Research Institute showed that on 14 separate farms, where part of a paddock had been sown to subterranean clover and the rest of the paddock had not, the average wheat yield on the non-clover land was 21½ bushels and on the clover land 35½ bushels.

A striking illustration of the value of pasture leys in cereal rotations is available from South Australia. Two counties have been surveyed. County Light, with 18 to 21 in. rainfall, has red-brown earth soils which were of moderate initial fertility. Wheat yields in the decade 1931-1940 were 17.4 bushels per acre. The development of pasture leys in this county, based on subterranean clover, has been slow, and yields in 1951-1960 have risen only by 2.4 bushels to 19.8 bushels.

On the other hand, County Gawler, with only 15 to 17 in. rainfall and mainly with mallee soils, has had great success with the use of barrel medic in pasture leys. Yields, which were 15.7 bushels in 1931-1940, have risen by 8.1 bushels to 23.8 bushels in 1951-60. Thus, through the more successful use of pasture legumes in cereal rotations, the county with the poorer virgin soils and the lower rainfall has now attained the higher wheat yields.

In Victoria, where average wheat yields are now 50 per cent higher than in prewar years, it is considered by the State Department of Agriculture that half the total increase can be attributed to the increases in soil fertility associated with leguminous leys, and the other half to new varieties and mechanisation.

A final example can be quoted from an individual property at Rosedale, South Australia, where through the use of subterranean clover leys the wheat yield has risen from 26 bushels in 1951-54 to 45 bushels in 1959-62, while the flock has increased from 251 to 625 and the fleece weight from 9.9 to 11.8 lb.

We should feel no little dismay that some fifty years were to elapse from the time William Farrer made the following observation (1893) until the validity of his viewpoint came to be realised on any substantial scale in the Australian cereal industry.

> I will conclude this letter by expressing my belief that if we hit upon a leguminous plant that can be economically grown with wheat, the yield of the latter would be so greatly increased that wheat growing would become a highly profitable industry.

These remarkable improvements are the result of something more than a new method or new technique. They arise from a changed environment—from the creation by sown pastures of good soils where poor soils existed before. The use of fertilized leguminous pastures stands as the greatest factor of favourable environmental change in our agriculture since first settlement.

What of the future?

Predictions are always hazardous, but we can certainly see before us great prospects both for increased agricultural production and for more efficient production. The extent to which these prospects are to be realised will depend on economic factors and markets, but if these are favourable we can look forward to great progress. Much land remains to be improved. As a single example, New South Wales, with 2½ times as much land as Victoria with over 15 in. rainfall, has less top-dressed pasture. All States have unimproved areas lying cheek-by-jowl with improved properties. Queensland may well have 100 million acres of land on which pasture improvement will prove possible. An example of the potential in Queensland is provided through recent studies at Gladstone, just south of the tropics, which show what can be done through the use of the pasture legume, Townsville lucerne. Liveweight gains per acre of beef cattle on spear-grass pasture have been raised from 23 to 100 lb. by the

use of Townsville lucerne, and to 205 lb. by the additional use of fertilizers.

Can we expect the average increase in sheep numbers of 3.3 per cent per annum to be maintained? If economic factors are favourable, the technical opportunity is certainly before us and the answer is "Yes". With an annual increase of say, 3 per cent, we will have an Australian flock of 265 million in 1980, compared to 165 million today. A further factor is the current evidence that higher stocking rates are possible on many improved pastures. Though heavier stocking will tend to keep down any increase in fleece weight, it could mean an even more rapid increase in sheep numbers and wool production than has occurred in the past fifteen years.

The future of beef production will depend considerably on the rate that pasture development proceeds in Queensland. In southern Australia there was a lag of twenty years between the first demonstration of the value of improved pasture and its widespread adoption, but this lag may be much less in Queensland because of the active research and extension programme, and the realisation of the gains that can be made. Much will depend on the seed supplies of newly developed pasture plants and the availability of capital.

The future of cereal yields

If we look at the future of cereal yields the forecast can be based on established trends. It is suggested that a great part of the 33 per cent increase in Australian yields from 1940-50 (12.8 bushels) to 1950-60 (17.1 bushels) has been through the use of pasture leys in rotations. It is considered that we can expect an average Australian yield through the present decade (1960-1970) of 20 bushels and in the next decade (1970-80) of 22 bushels. Even this may prove a modest forecast, because as well as the further effect of pasture leys the present Australian wheat breeding programmes hold great promise of varieties better adapted to the improved level of fertility and thus capable of considerably higher yields. A doubling of yields from 1940-1950 to 1970-1980, is by no means impossible.

Work on pastures in Australia

Extension workers are applying our present knowledge of pasture improvement to additional properties and to new areas, but we also need more information on many aspects of pasture development. Three aspects can be recognised, namely the production of better pastures, the more effective utilisation of the pastures and the utilisation of the added soil fertility.

In the production sphere there are still many gaps in our knowledge on such topics as the use of phosphatic fertilizers, their residual value, the use of concentrated superphosphates containing no sulphur and the role of fertilizer nitrogen. Satisfactory legume species are not yet available for some districts. Pasture utilisation in particular calls for much more work. In general, set stocking has given wool, meat and milk production just as high as under rotational grazing, but as stocking rates are increased, this relationship may show some change. In the utilisation of the soil fertility built by pastures, cropping is obviously the effective way of "cashing-in" on the fertility. This is occurring in cereal areas where pastures alternate with crops, but there are other areas devoted to permanent pastures which must give consideration in future years to crop production as part of the pattern of land use. Cropping has already been adopted extensively in pasture districts in Western Australia and will undoubtedly develop in other pasture areas of suitable topography.

Concluding comment

I believe that in the next twenty years, pasture improvement has more to offer Australia than any other country in the world. In many countries the problems of population pressure, economic resources, religious or sociological factors, the lack of mineral and power resources or of technical knowledge or skills will limit the role of pastures in food production or fertility improvement. In Australia we have vast areas of infertile "improveable" soils within good rainfall zones, we have the necessary economic resources, and we have a considerable experience and a growing knowledge of suitable

animals, pasture plants, fertilizer practices and establishment techniques. We are in a phase of development in which pastures are enabling dramatic change of our agricultural environment and a transformation of soil fertility and production levels. While our efforts must be distributed across the whole field of agriculture, it is logical and proper that there should be specific concentration of effort on pasture development, which is proving so rewarding in our production and stability. We have the opportunity to convert the better watered one third of Australia, with its great areas of infertile soils, into lands of substantial productivity. ●

The full text of this address appears in the January, 1965 issue of the *Australian Journal of Science.*

Farrer Medallist for 1964, *Professor C. M. Donald, D.Sc.Agr., H.D.A., F.A.I.A.S., of the University of Adelaide, delivered the Farrer Memorial Oration at a special meeting of the Australian Institute of Agricultural Science (N.S.W. Branch) in Sydney on* 24 *September,* 1964.

Chairman of the Farrer Memorial Trust, Dr. Grahame Edgar, New South Wales Director-General of Agriculture, presented the 1964 *Farrer Medal to Professor Donald at the meeting.*

The medal is an annual award by the Trust for outstanding service to Australian agriculture.

The Medallist's oration commemorates the work of Australia's pioneer wheat breader William James Farrer.

Biographical

Professor Donald entered Hawkesbury Agricultural College in 1926 *on a scholarship as a boy migrant from the United Kingdom.*

In 1932, *as a cadet of the New South Wales Department of Agriculture, he graduated from the University of Sydney.*

He was appointed an agrostologist of the Department in 1933.

In 1934 *he joined C.S.I.R.O., and was with that body until* 1954.

During this time he was engaged in pasture research at the Waite Institute (1934-9); *Pawlett travelling scholarships to the United Kingdom, United States of America, and New Zealand* (1939-41); *with the Division of Plant Industry, at Canberra* (1941-2).

He was seconded to the Department of War Organization of Industry in 1942, *and became Assistant Director in Charge of Rural Division.*

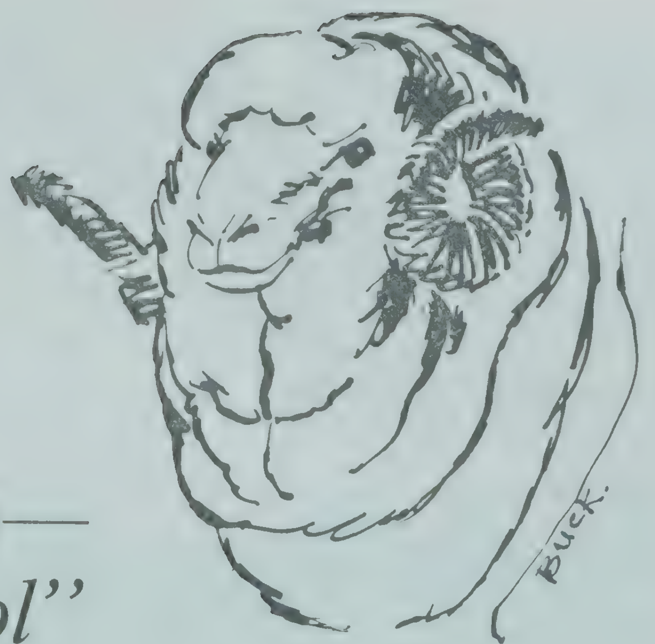
In 1945 *he returned to the Division of Plant Industry in Canberra, became Assistant Chief of the Division and responsible for pasture work in southern Australia.*

He was a member of the 1951 *F.A.O./O.E.E.C. mission to advise on pasture development in Mediterranean countries.*

In 1954 *Professor Donald was appointed to his present position of Professor of Agriculture and Head of the Department of Agronomy, Waite Agricultural Research Institute, at the University of Adelaide.*

Since this appointment he has also advised on grassland development in Argentina and Ceylon; been appointed Visiting Professor, Cornell University, U.S.A. (1960); *and advised on Colombo Plan aid in university agricultural education in Indonesia.*

He was a member of the Australian delegation to the United Nations' Conference on the Application of Science and Technology in the Less Developed Countries, at Geneva in 1963.



"I keep my wool on—and stay cool"

R. D. EASTOE

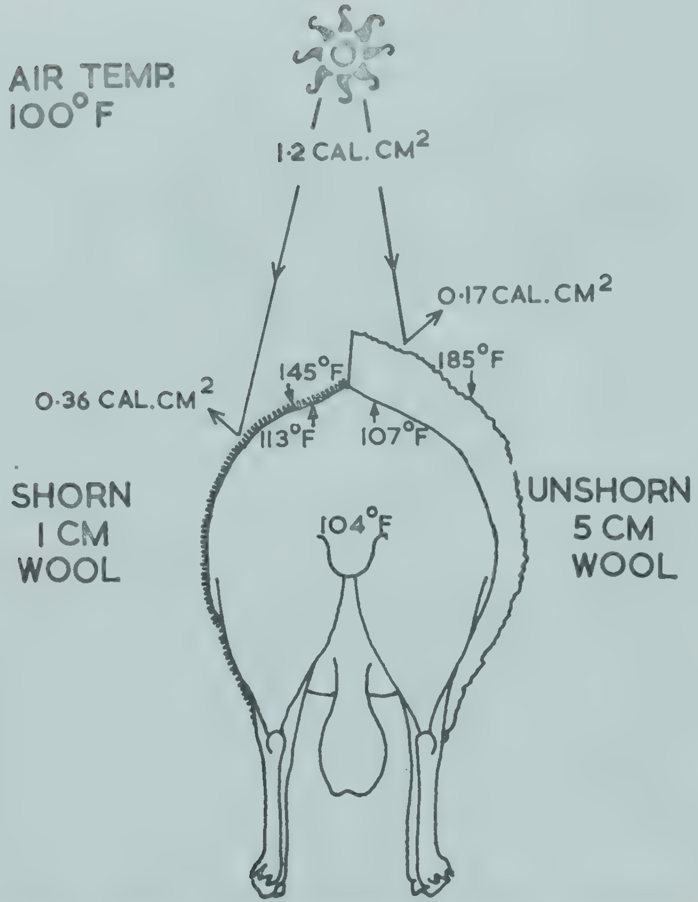
THE FLEECE insulates the sheep against the heating effects of the sun. In an hour on a hot sunny day the amount of heat striking a sheep could bring half a gallon of freezing water to the boil.

Fortunately, a sheep has an excellent ability to regulate body temperature. Further, a fleece protects the skin from high or low temperatures. Wool is a good insulator, so if there is some length of wool, most of the heat on the tip does not reach the skin. Recently shorn sheep lack the protection of a fleece, even though the white surface reflects a lot of heat.

The wool tip on unshorn sheep will be hotter than the wool tip on shorn sheep because it is darker and does not reflect much heat. But the insulating effect of the fleece is such that it more than overcomes the effect of the tip temperature. With an air temperature of 100°F. the skin temperature on a shorn sheep could be 6° higher than that of a woolly one.

The amount of heat reaching the skin becomes less as the wool grows, until the length reaches about two inches. After

The Author: *Mr. R. D. Eastoe, Special Livestock Officer (Sheep and Wool), Farrer Place, Sydney.*



TEMPERATURE BALANCE OF A RAM IN SUNSHINE

—*After Macfarlane.*

this, additional length does not improve the insulation.

In high temperatures, a sheep's actions will show the amount of discomfort it feels. It is usual for a sheep to breathe through its nostrils, but when too hot it will pant with its mouth open. This is a sign that steps need to be taken to allow it to cool off.

Breathing is faster under hot conditions, as would be expected, but a shorn sheep will breathe very much faster than a woolly one in hot weather.

The body temperature will rise more quickly in poor sheep than those in good condition, particularly when they are moved about. But poorer ones will lose this heat much more quickly when the stress is taken off.

Knowledge of the effect of heat can be applied to sheep management. For example there is an increasing interest in shearing in autumn, when high temperatures can affect newly shorn sheep. With autumn shearing, in some areas it may be necessary to provide shade for protection from the direct rays of the sun and to reduce the skin temperature.

This applies particularly to rams. They should not be forced to put up with conditions that will unduly raise body temperature. Fertility is affected by high body temperatures and so these need to be avoided as the mating season approaches. Any management aspect likely to assist rams to keep body temperature about normal is worthwhile. Shearing rams twice a year is a sound practice and one frequently adopted by the industry. It is essential that shearing be timed to allow some growth of wool on rams during hot months.

Sympathy is often expressed for sheep carrying wool through the summer months. The sympathy is misplaced as they are more comfortable with some wool cover.

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WHEAT VARIETY RECOMMENDATIONS FOR 1965

C. WALKDEN-BROWN and R. W. FITZSIMMONS

Modern combines sowing wheat seed into a well-prepared seedbed. For best results recommended varieties and optimum seed and fertilizer rates must be used.

WHEAT VARIETY RECOMMENDATIONS for 1965, considered by the Standing Advisory Committee on Wheat and approved by the Minister for Agriculture, Mr. Enticknap, are made for all the main agricultural regions of the State.

North to south, the New South Wales wheat belt extends from the Queensland border to the Victorian border. It is bounded on the east by the Great Dividing Range. The western boundary is determined by limitation of rainfall, but in the main lies along a line joining Bogabilla, Moree, Coonamble, Lake Cargelligo, Hillston, Griffith, Finley and Balranald.

Wheat growers are strongly advised to sow only those wheat varieties recommended for particular regions of the State. The desirability of this has been stressed by the Standing Advisory Committee on Wheat. The Committee comprises representatives of the Department of Agriculture, farmers' groups, the Chamber of Commerce, milling, baking, handling, marketing and shipping interests, and Sydney University. Each year it critically reviews wheat-sowing recommendations in the light of all available information and viewpoints.

This article, in addition to listing the varieties recommended for general sowings in 1965, covers some other important matters of interest to wheat growers. For further information, growers should make use of the advisory services of the Department of Agriculture, by referring problems

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The agricultural regions of New South Wales for cereal variety recommendations

Heavy dotted line represents the approximate western and eastern limits of economic wheat production for grain.

Light dotted line represents the approximate northern and western limits of recommended soft wheat zone.

REGIONS

1. North Coast
2. Mid Coast and Hunter
3. South Coast and Tablelands
4. Northern
5. North Western
6. Western
7. Mid Western
8. Southern
9. South Western

to their district agronomists who are located at the following centres in the wheat belt:

North: Armidale, Glen Innes, Gunnedah, Inverell, Moree, Tamworth.

Centre: Bathurst, Cowra, Coonabarabran, Dubbo, Mudgee, Orange, Parkes, West Wyalong.

South: Albury, Barham, Cootamundra, Deniliquin, Finley, Goulburn, Griffith, Leeton, Queanbeyan, Tumut, Wagga.

Main changes

Only minor variety changes have been made for 1965 compared with 1964.

Eureka and Warigo have been deleted from the Northern and North Western regions, and from the western part of the Western Region, in favour of Festiguay. Both Eureka and Warigo are now susceptible to one or more prevalent races of stem rust whereas Festiguay is resistant, at ordinary temperatures, to all races of rust known to occur in the field. Also, if Festiguay is sown early it will escape damage from normal winter frosts. Festiguay has replaced Eureka in the irrigation areas where rust can be a serious problem.

Mendos—a new rust resistant wheat suitable for late sowing in certain regions.

Mengavi has been deleted from the Northern and North Western regions is favour of Mendos. Mengavi is susceptible to two prevalent races of rust whereas Mendos is resistant to all races known to be present in the field. In addition, the baking quality of Mendos is superior to that of Mengavi and similar to that of Gabo.

Acting on advice from the Wheat Board, the Advisory Committee recommends the growing of only soft wheat varieties east and south of a line running approximately through Denman, Merriwa, Coolah, Neilrex, Dubbo, Eugowra, Grenfell, Bribbaree, and Griffith. Observance of these recommendations by growers should result in the delivery of a relatively homogeneous sample of grain instead of a mixture of hard and soft grains.

Frost damage

Frost causes more consistent annual damage to wheat in this State than any parasitic disease. In the 1958-59 season, when frost damage was fairly widespread, the New South Wales wheat yield loss attributable to frost damage was estimated to be about 12 per cent., or 9,300,000 bushels, valued at £6,250,000. The record yields of both 1963-64 and 1964-65 seasons were in no small measure attributable to the fact that in those years severe frost injury was not widespread.

Because of the difficulty farmers may have in recognising frost injury there is a tendency to under-estimate its seriousness, and a general failure to adopt measures to reduce losses.

No commercial variety grown in this State has high resistance to stem frosting. Winter wheats often escape damage because they remain prostrate longer than the widely grown "spring" wheat types. Generally, later maturing varieties are hardier or have a better chance of escaping damage. The variety Falcon, which is of early to mid-season maturity, is prone to stem frosting if sown early. All commercially grown varieties are susceptible to head frosting.

Quick maturing varieties sown too early are invariably more subject to stem and head frost damage than when sown late in the season.

Timely sowing pays

In some years many wheat crops of quick maturing varieties sown too early almost completely fail to produce grain, because of frost damage.

Time of sowing is particularly important; perhaps more so today with modern farming equipment, when large areas can be seeded in a matter of a few days: also because the later maturing varieties previously grown have been replaced with wheats having a shorter growing season. Moreover, some of the newer varieties, though more resistant to disease, are also more susceptible to cold injury. Varieties are classified as suitable for very early to

early sowing, early to midseason sowing, or midseason to later sowing, in relation to the normal range of sowing dates for the district.

Obviously, the best sowing time for each variety will depend, to some extent, on the district in which it is to be grown. As an example, some slow maturing varieties may do better in some localities if sown midseason. This applies to portion of the north-west and to irrigated areas. In cooler districts a quick maturing wheat (one sown late), if sown too late, fails to make satisfactory growth, because winter conditions are too severe.

Winter wheat varieties such as Windebri and Winglen may be sown as early as grazing oats, that is, in February or March. But if conditions then are not suitable, satisfactory results can be obtained from April to May sowings.

Midseason to late maturing spring wheat varieties should be sown from mid-April to mid-May. Recommended varieties included in this group are, in sowing order: Pinnacle, Bordan, and Olympic. Festiguay, being of semi-winter habit, can be sown at the same time as any of these varieties.

Early to midseason maturing spring wheat varieties should be sown later—late May to mid-June. Recommended varieties included in this group are, in sowing order: Heron, Falcon, Mengavi, Gamenya, Mendos and Spica.

Heron, though quick maturing, is more tolerant of frost than other varieties of similar maturity; if sown early, however, Heron can still be severely damaged by frost.

The sowing dates are only approximate and may be extended either way, depending on soil and climatic conditions. In the north-west, June sowing of quick maturing wheats, on heavy fertile soils, is sound practice. In the drier western and south-western wheat areas, if rain falls early in the growing season it is usually safer to sow a little on the early side and risk frost damage. District agronomists can furnish specific information in regard to the best sowing dates for each region.

Seeding rates and fertilizer

Quantity of seed sown, and fertilizer needs vary considerably according to district, soil type and fertility, time of sowing, and whether irrigation is practised. Growers are advised to consult their district agronomist for specialised local advice.

Stem rust resistance

For practical purposes it can be said that the only commercially grown wheat varieties in New South Wales fully resistant to stem rust are Festiguay and Mendos. The degree to which varieties at present resistant to some strains of stem rust might in future be affected by the disease depends upon the rate of build-up of spores of the strains that can attack them.

Festiguay—a new rust resistant wheat suitable for early sowing in certain regions.

Table 1. Resistance of recommended varieties to some of the main prevalent strains of stem rust

Most prevalent strains (of the 20 at present in the field)	Group 1. Heron, Winglen, Windebri	Group 2. Gamenya	Group 3. Mengavi	Group 4. Spica	Group 5. Festiguay Mendos
21-2	S	R	R	R	R
21-1, 2	S	R	R	R	R
21-2, 3	S	S	R	R	R
21-4, 5	R	R	S	S	R
21-5	R	R	R	S	R
34-2	S	R	R	R	R
34-2, 4	S	R	S	R	R

N.B.—For practical purposes varieties in Group 1 are fully susceptible.

R = Resistant. S = Susceptible.

Mengavi is now susceptible to stem rust 21-4,5 and 34-2,4 both of which are now widespread.

Strains capable of attacking Gamenya were fairly widespread in 1964.

Wheat growers in rust liable areas, when planning their 1965 sowings, are advised to keep in mind the fact that certain groups of varieties are attacked by different strains of stem rust. They should select for sowing varieties from more than one group. For example, of the recommended varieties, Spica is in one group, Mengavi is in another group, Gamenya in another, Festiguay in another and Mendos in yet another.

Although Heron, Winglen and Windebri, are resistant to strains 21-4,5 and 21-5, for practical purposes they are now susceptible to stem rust.

The macaroni wheat Dural, although classed as susceptible, has some tolerance to stem rust in the field.

Falcon, Olympic, Pinnacle and Bordan are classed as completely susceptible, although the latter at times shows some field tolerance in less rust-liable areas.

Guard against root rots

Root and foot rots and takeall are responsible for appreciable yield losses throughout the State wheat belt. Whilst in many cases the plants have been predisposed to these diseases by frost injury, good farming practice can do much to minimise losses. As these diseases can be carried on pasture grasses, it is inadvisable to sow wheat or barley as the first crop after natural or improved pasture. Instead, oats or linseed, which are resistant to root rots, should be sown first. Continuous cropping of wheat and barley should be avoided on land where root rots are known to occur. Under such conditions stubble burning is recommended, but only as a partial control.

Crops should not be grazed except where sown primarily *for* grazing, as are winter wheats, or where grazing is necessary for economic reasons or to check frost injury or lodging. Grazing usually reduces yields, and injures the crowns of plants, possibly facilitating entry of root and foot rot fungi.

Beware of bunt

Of all the presently grown varieties only Heron is resistant to bunt. Satisfactory control of the disease can be achieved by using fungicidal seed treatments. The materials most frequently used are organic mercury compounds, copper compounds, and hexachlorbenzene. Hexachlorbenzene gives excellent control of bunt, but has the disadvantage of failing to control other diseases which are controlled, at the same time as bunt, by the other compounds.

Dusting the seed

Organic mercury seed treatments are recommended for the control of bunt. These treatments also have other advantages. They reduce seed-borne infection with fungi capable of causing root and foot rots, and protect against seed rot and damping-off in the soil. Routine use of organic mercury seed treatments on all seed wheat is strongly recommended by the Department.

Loose smut

Loose smut was more prevalent in wheat crops last year than normally. Overall, the effect upon yield was not great, but a marked reduction in yield occurred in isolated crops.

Control of loose smut is not practicable on the farm, as the disease spores develop inside the grain in the early stages after flowering.

At present the disease can only be controlled by use of a complicated hot water treatment, such as used in the early stages of the Department's pure seed production programme. As this treatment is only practicable in the early stages of pure seed production, it is possible if conditions are favourable at flowering time for re-infection to occur at a later stage in the seed programme. Experiments are now in progress seeking a simplified treatment for control of this disease.

Chemical treatments used for control of bunt and other diseases on the surface of the grain are ineffective against loose smut.

The chemicals cannot penetrate to the inside of the grain to kill the smut fungus.

Where possible, wheat growers are advised to use seed for this year's sowing from crops known to be loose-smut-free last year.

Flagsmut increasing

The disease flagsmut, which was of considerable economic importance before the advent of resistant varieties, is increasing, particularly in the north, where mainly flagsmut susceptible varieties have been grown since the advent of Gabo.

Where flagsmut has shown up, growers should seriously consider growing a resistant variety recommended for the area concerned—at least in alternate years. Burning off stubble will also help reduce incidence of this disease.

Of the present recommended varieties the following have at least moderate resistance to flagsmut: Bordan, Dural, Falcon, Festiguay, Heron, Olympic, Pinnacle, Windebri, and Winglen.

Chemical control of wild oats

Wider farmer use of two new herbicides in 1964 showed that effective control of wild oats and Wimmera rye grass in wheat and barley is now practicable.

Avadex ®, applied at sowing, controls both weeds, whilst Carbyne ®, applied soon after germination, is effective only against wild oats. Recommendations for use of these herbicides have been reviewed in the light of earlier experiences, and district agronomists are in a position to advise inquirers on details of this subject and other weed problems.

Winter wheats

Winter wheat varieties Winglen and Windebri are recommended for sowing in some areas. These varieties can be sown as early as February or March because they remain in the vegetative phase until early spring. There is, therefore, little risk of stem frost damage. However, they are now susceptible to stem rust and, if weather conditions are suitable, very early sowing of these varieties could result in a rapid build-up of stem rust spores before the cool weather commences. Farmers should bear this in mind before planning extensive sowings. Also, crops of early-sown winter wheat should be heavily grazed at least once during the winter to minimise the build-up of rust. Winter wheats are normally sown primarily for grazing. The check caused by grazing at times predisposes the plant to root and foot rot injury, so it is not wise to use winter wheat in the rotation as a complete replacement for oats.

® registered trade name.

Modern self-propelled headers harvesting a heavy yielding wheat crop. Best yields come from recommended varieties.

The newly released spring wheat variety, Festiguay, has a semi-winter habit of growth. Thus it can be sown earlier than the normal spring wheat varieties, with little likelihood of severe damage from normal winter frosts. It cannot, however, be sown as early as the true winter wheats, nor does it provide as much grazing as winter wheats prior to recovery for grain.

Grain production

The officially recorded grain production for 1963-64 season (the last for which statistics are available), was a record 122,472,114 bushels from 4,963,811 acres sown for grain from a total sowing of 5,150,814 acres. This gave a record average yield of 24.7 bushels per acre. In comparison, the average yield per acre over the ten years ending 1963-64 was 18.9 bushels.

Average production over the same ten years was 67,023,800 bushels from an average area sown to grain of 3,553,000 acres. Interest in wheat has revived to a marked degree since 1956-57, in which year only 1,742,000 acres was sown for grain.

In 1964-65, from which year production statistics are not yet available, fresh records in acreage, production, and average yields are expected.

Popularity of varieties

Major changes have occurred in the popularity of wheat varieties, reflecting the realisation of the greater productivity of new varieties.

Heron now occupies first position with 14.3 per cent of the total acreage, having risen from third place the previous year.

Mengavi is now in second place and was the most popular variety in the north-west. However it is now expected to drop in popularity in favour of Mendos, which is similar in yield and resistant to stem rust.

Olympic declined slightly in popularity, probably in favour of Falcon and Heron, and probably because of its tendency to toughness in stripping.

Glenwari, the most popular variety for four years, receded to fourth place in 1963-64. It is expected that Glenwari will continue to drop in acreage in favour of Falcon and Heron.

Gamenya and Falcon are now in fifth and sixth places respectively having doubled in area since the previous census. It is expected that the acreage of both these varieties will continue to increase.

The 1963-64 statistics show a decline in popularity of Olympic, Glenwari, Bencubbin, Bordan, Festival, Gabo, Eureka, Pinnacle, Koda, Sabre, and Spica, whilst increases occurred with Heron, Falcon, Gamenya, and Mengavi.

Table 2 shows percentage acreage of leading varieties in recent years.

Table 2. Acreage percentages of the present leading nine varieties over the last nine censuses

Variety	1954-55 per cent	1955-56 per cent	1956-57 per cent	1957-58 per cent	1958-59 per cent	1959-60 per cent	1960-61 per cent	1962-63 per cent	1963-64 per cent
Heron ..	..	..	..	..	..	..	..	9·1	14·3
Mengavi	..	..	..	..	..	..	..	8·2	10·9
Olympic	..	..	..	..	..	1·7	4·2	9·2	8·8
Glenwari	4·8	6·3	11·1	15·3	16·1	21·1	20·4	13·1	8·6
Gamenya	..	..	..	..	..	..	..	3·8	7·7
Falcon ..	..	..	..	..	..	..	..	2·7	7·3
Bencubbin	37·5	33·3	22·1	19·2	15·3	12·4	10·1	6·6	4·7
Insignia	..	..	..	..	..	2·5	3·4	4·1	3·8
Gabo ..	18·1	20·3	24·4	26·2	20·1	12·1	9·0	5·4	3·6

N.B.—No wheat variety census was made for the 1961-62 season.

VARIETIES RECOMMENDED FOR GRAIN

Northern Agricultural Region

Tamworth (regional headquarters), Manilla, Barraba, Bingara, Gravesend, Warialda, North Star, Yetman, Delungra, Inverell, Tenterfield, Glen Innes, Guyra, Armidale.

Very early to early sowing for grazing and grain: Winglen, Windebri.

Early to midseason sowing: Festiguay.

Midseason to late sowing: Gamenya, Spica, Mendos.

North Western Agricultural Region; and Western Portion of Mid Coast and Hunter Region

Northern section: Gunnedah (regional headquarters), Boggabilla, Garah, Milguy, Moree, Biniguy, Wee Waa, Pilliga, Narrabri, Bellata, Baradine, Boggabri, Mullaley, Quirindi, Spring Ridge, Tambar Springs, Premer, Coonabrabran, Binnaway, Mer riwa. Southern section: Coolah, Mendooran, Dunedoo, Cassilis, Scone, Muswellbrook, Denman.

Very early to early sowing for grazing and grain. Winglen, Windebri—northern section only.

Early to midseason sowings: Festiguay—northern section only; Bordan, Olympic—southern section only.

Midseason to late sowing: Gamenya, Mendos—whole region; Spica—northern section only; Heron—southern section only.

Western Agricultural Region

Eastern section: Orange (regional headquarters), Wellington, Birriwa, Gulgong, Mudgee, Molong, Manildra, Cudal, Eugowra, Blayney, Bathurst. Western section: Coonamble, Gular, Armatree, Curban, Tooraweenah, Gilgandra, Collie, Eumungerie, Dubbo, Trangie, Narromine, Tomingley, Yeoval, Wongarbon.

Early to midseason sowing: Olympic—whole region; Bordan—eastern section only; Festiguay—western section only.

Midseason to late sowing: Heron, Gamenya—whole region; Falcon—western section only.

Mid Western Agricultural Region

Eastern section: Cowra (regional headquarters), Canowindra, Woodstock, Greenethorpe, Koorawatha, Young, Boorowa. Western section: Tottenham, Albert, Tullamore, Trundle, Bogan Gate, Condobolin, Tullibigeal, Ungarie, Cargelligo, Wyalong, Quandialla, Bribbaree, Grenfell, Parkes, Peak Hill, Forbes.

Early to midseason sowing: Olympic—whole region; Bordan—eastern section only.

Midseason to late sowing: Heron, Gamenya—whole region; Falcon—western section only.

Southern Agricultural Region; and Southern Tablelands portion of South Coast and Tablelands Region

Stockinbingal, Cootamundra, Murrumburrah, Gundagai, Tumut, Batlow, Tumbarumba, Wagga (regional headquarters), Temora, Ariah Park, Ardlethan, Ganmain, Coolamon, Junee, Lockhart, The Rock, Henty, Holbrook, Albury. Goulburn (regional headquarters), Bigga, Tuena, Binda, Crookwell, Taralga, Gunning, Yass, Bungendore, Queanbeyan, Canberra, Dalgety, Delegate, Bombala.

Early to midseason sowing: Bordan, Olympic.

Midseason to late sowing—Heron, Gamenya.

South Western Agricultural Region

Northern section: Hillston, Merriwagga, Rankin Springs, Goolgowi, Erigolia. Southern section: Leeton (regional headquarters), Barellan, Griffith, Carrathool, Grong Grong, Narrandera, Urana, Oakland, Rand, Corowa, Tocumwal, Berrigan, Jerilderie, Deniliquin, Mathoura, Moama, Moulamein, Balranald.

Early to midseason sowing: Olympic—whole region.

Midseason to late sowing: Heron, Gamenya—whole region; Falcon—northern portion only.

Irrigated Areas—in all regions.

Early to midseason sowing: Pinnacle, Olympic, Festiguay.

Midseason to late sowing: Heron, Mengavi, Gamenya.

Recommended Durum wheats

Durum wheats are especially suited for the commercial production of high quality macaroni-type semolinas. To produce a good quality product of high protein content these wheats must be sown on highly fertile soils in suitable districts. Dural is recommended for sowing on such soils on the north-western slopes and plains. Durum varieties are not bread wheats and must not be delivered as such.

Hay varieties

Of the varieties recommended for different parts of the State none are specifically recommended as being suitable only for hay production. However, Bordan, Olympic and Festiguay are recommended for dual purpose sowing for hay or grain.

Recommended green fodder varieties for coastal districts

Early sowing: Festiguay.

Midseason sowing: Gamenya.

NOTES ON VARIETIES

The following descriptions of recommended varieties are given as a guide to farmers in the choice of the best varieties of wheat for their conditions.

Bordan

Bordan is recommended for early sowing in the better rainfall districts. It is tall-growing and the straw is of fair strength. Bordan has some tolerance to stem rust in less rust-liable areas and is moderately resistant to flagsmut. The grain is of medium strength. In many respects Bordan resembles Ford, which it can usually out-yield in districts of good rainfall. However, it does not finish as well should late spring be dry.

Bordan was selected from the cross (Bearded Reiti × Ford) × Dan, made at Roseworthy Agricultural College, South Australia. It was released in 1924.

Dural

Dural was selected from the cross Aleppo × Palestine. It was selected specifically for the production of high quality macaroni-type semolinas and is suitable for growing on the more fertile soils in the north-west where a high protein content is usually obtained. Dural has a white, compact, bearded head. The grain is white and vitreous. Its maturity is late, being up to ten days later than Gamenya and Mengavi. The straw is of medium height and strength. It has good resistance to flagsmut and some tolerance to prevalent strains of stem rust. In northern New South Wales, yields of Dural have been

approximately equal to those of Warigo. Dural is not a bread wheat, and must not be delivered as such.

Dural is recommended for sowings on the more fertile soils on the north western slopes and plains.

Falcon

Falcon was bred and selected at Temora Agricultural Research Station from the cross Gular × (Dundee × Gular) × Bencubbin. It combines high yield with medium strength baking quality. Falcon is classed as a hard wheat, both from the point of view of appearance, and physical hardness as it affects milling. The yield compared well with Bencubbin and Glenwari in many trials carried out in southern New South Wales, and was superior to Javelin 48. Falcon should not be sown too early, otherwise it is liable to frost damage.

Early growth is erect and the straw medium tall and of moderate strength. Falcon is early midseason in maturity. The ear is white, square and has long tip awns. Before ripening, the head becomes a distinct steely-blue colour. Grain is white and vitreous.

Falcon is resistant to flagsmut but susceptible to stem and leaf rusts.

Festiguay

Festiguay was selected at Tamworth Agricultural Research Station from the cross Festival × Uruguay made at Glen Innes Agricultural Research Station. It is semi-winter in habit, and can therefore be sown early with little danger of damage from normal winter frosts.

The early growth is erect and strong and the straw fine and slender and of moderate strength. The ears are white, clubbed, and partly bearded.

At ordinary temperatures, Festiguay is resistant to all races of stem rust known to be present in the field. It is moderately resistant to flagsmut.

Festiguay is a hard wheat, of attractive appearance and good bushel weight, and has the ability to finish well. It has good baking quality, especially at high protein levels, and is superior to Eureka in this regard. There is a tendency to overstable dough characteristics which would be undesirable, particularly at lower levels of protein.

Main features of the recommended varieties

Variety	Maturity	Baking Quality	Disease Resistance	Remarks
Bordan	Late	Medium strong	Susceptible, but at times shows some field tolerance to stem rust in less rust - liable areas. Moderate flagsmut resistance.	Holds grain tightly.
Dural	Late	Not a bread wheat (see remarks).	Some field tolerance to the prevalent strains of stem rust. Resistant to flagsmut.	Grain is suitable only for the manufacture of semolinas for spaghetti, macaroni, etc.
Falcon	Early to mid-season.	Medium strong	Susceptible to stem rust; resistant to flagsmut.	Moderately strong straw of medium height.
Festiguay	Midseason	Strong	Resistant to stem rust and flagsmut.	Escapes damage from normal winter frosts. (Semi - winter habit).
Gamenya	Early	Strong	Susceptible to stem rust strain 21-2, 3. Susceptible to flagsmut.	Similar field appearance to Gabo (moderately short straw, poor grain finish).
Heron	Early	Soft	Resistant to flagsmut and bunt. Susceptible to main stem rust strains.	Short, erect straw.
Mendos	Early	Strong	Resistant to stem rust; susceptible to flagsmut.	Baking quality similar to Gabo.
Mengavi	Early	Strong	Susceptible to stem rust strains 21-4, 5 and 34-2, 4. Susceptible to flagsmut.	Shorter straw than Gabo.
Olympic	Midseason	Soft	Susceptible to stem rust; resistant to flagsmut.	Moderately strong straw of medium height.
Pinnacle	Late	Soft	Susceptible to stem rust; resistant to flagsmut.	Short strong straw.
Spica	Very early	Strong	Susceptible to stem rust strains 21-4, 5 and 21-5.	Heavily bearded; weak straw.
Windebri	Late	Strong	Susceptible to main stem rust strains; resistant to flagsmut.	Tall straw of moderate strength. Winter habit.
Winglen	Late	Strong	Susceptible to main stem rust strains; resistant to flagsmut.	Tall straw of moderate strength. Winter habit.

Gamenya

Gamenya was selected from the cross Gabo × ((Gabo^5 × Mentana) × Gabo^2 × Kenya 117A). The ear is white, compact, strongly tip awned, and glabrous. Auricles are non hairy. The grain resembles Gabo in many respects and prime samples are rather angular in appearance. The grain is deeply creased. It is in a similar baking quality group to Gabo.

Under north-western conditions Gamenya is approximately three days later than Gabo. The straw height resembles that of Gabo. Gamenya is susceptible to flag smut and is now susceptible to stem rust strain 21-2, 3.

Gamenya has a wider range of adaptation than Mengavi, yielding quite well in central and southern areas, as well as in the north.

It is the highest yielding variety at present grown in northern areas and was the fifth most popular variety in 1963.

Heron

Heron was selected from the cross R.D.R. × 4 Insignia 49 and was released by the Wagga Agricultural Research Institute. This variety is very similar to Insignia and has the advantage of bunt resistance. It is resistant to flagsmut but susceptible to the main strains of stem rust. It has short, strong straw and stands well. Because of the short straw and upright growth, this variety competes poorly with skeleton weed unless adequate (spray) control measures are taken. The head is semi-compact, brown chaffed with short awns, and is easy to thresh. Baking quality is in the soft wheat class.

Heron is the highest yielding early maturing variety in central and southern areas and has increased rapidly in popularity since its release. In 1963 it was the most popular variety in the State.

Mendos

Mendos was bred by Sydney University from the cross ((Spica × Koda) × Gabo) × Mengavi sib. and is designed as a replacement for Mengavi. It is resistant to all races of stem rust known to be present in the field.

Mendos is of excellent milling and baking quality, is in the strong premium class, and is a most suitable replacement for Gabo and Mengavi in this regard.

Yielding ability is similar to that of Mengavi. The ear is white, tapering and tip bearded. The young growth is spreading with medium tillering; the straw is fine and yellow and of good strength. It is slightly earlier than Gabo in maturity.

Mengavi

Mengavi was selected from the cross (Gabo^6 × Mentana) × (Gabo^2 × (Eureka × C.I. 126321)). The ear is white, very strongly tip awned, and glabrous. The auricles are hairy. The grain is more plump than Gabo with a slightly higher bushel weight. It is of similar baking quality to Gabo. Under north-western conditions Mengavi matures about six days later than Gabo. Straw and ears are slightly shorter than those of Gabo grown under the same conditions.

Mengavi is susceptible to flagsmut and is now susceptible to stem rust strains 21-4, 5 and 34-2, 4.

Mengavi does not yield as well nor is it as widely adaptable as Gamenya. It increased in popularity faster than Gamenya because it held its rust resistance longer. Now that both varieties are susceptible to one or more strains of rust, some of the area now sown to Mengavi could be replaced by Gamenya and Mendos because of the higher yield of Gamenya and better rust resistance of Mendos.

In 1963 Mengavi was the second most popular variety in the State.

Olympic

Olympic was selected from the cross Baldmin × Quadrat, made at the State Research Farm, Werribee, Victoria, in 1937. It was selected at Longerenong Agricultural College and named in 1956.

Olympic is a midseason variety with fine, upright early growth. Straw is medium tall and of fairly good strength. The ear is creamy white, square at the base, tapering, and with long tip awns. Grain is white, opaque, plump, and of good milling quality.

Baking quality tests show that it is superior to Bencubbin.

Olympic has given very satisfactory yields in many central and southern districts over the last few years in comparison with Bencubbin. It is susceptible to stem rust, but resistant to flagsmut. It is tough to strip.

Olympic is the highest yielding midseason variety in central and southern areas, and has increased rapidly in popularity in recent years. In 1963 it was the third leading variety in the State.

Pinnacle

Pinnacle is a late maturing wheat with short, strong straw. It is the result of a selection from Pindar, made by the Victorian Department of Agriculture. It was released in 1946. Pinnacle is resistant to flagsmut but susceptible to leaf and stem rusts. Baking quality is in the soft wheat class.

Pinnacle has yielded well in trials in southern districts, and has good field characteristics for areas where skeleton weed is not a problem, and under irrigation.

Spica

Spica was bred by the Queensland Department of Agriculture from a cross between an unfixed hybrid (Three Seas × Kamburico) and an unnamed hybrid selection (Pusa × Flora 3202). Important features of Spica are its resistance to all main prevalent strains of stem rust except strains 21-4, 5 and 21-5, and very early maturity. It has prominently awned or bearded heads, and straw that is inclined to be weak.

Because of its very early maturity, Spica should be sown very late or frost damage will occur.

Spica is a particularly free milling wheat. It has been classed as strong in its baking quality under older baking methods, but is now suspect in the automated bakehouse. The quality of Spica under modern conditions is being investigated.

Windebri

Windebri is a sister line to Winglen (see description). Its main morphological difference from Winglen is that the head is brown instead of white, and it matures a few days earlier. In early growth, Windebri is slower than Winglen and produces less grazing. In general, grain yields of Windebri are higher than those of Winglen. Grain quality of the two varieties is similar.

Winglen

Winglen was selected from the cross (Kenya × Gular × Winter Minflor) × (Double Cross × Dundee × Dundee). It is late maturing and has good quality grain —comparable to Gabo. The head is white and compact. Straw is tall and of moderate strength. Winglen is a dual purpose variety, suitable for grazing and subsequent recovery for grain. It is resistant to flagsmut and is now susceptible to main strains of stem rust.

ACKNOWLEDGEMENTS

Assistance in compiling certain sections of this article was given by officers of the Divisions of Plant Industry and Science Services, and Professor I. A. Watson, of the University of Sydney. This assistance is gratefully acknowledged. ●

Reduce Fruit Bruising

Much bruising on apples and pears arriving at Sydney markets could be avoided by proper packing.

Four pieces of strawboard instead of the usual two will go a long way towards reducing fruit bruising.

Strawboards on the sides of the cases, as well as the usual strips top and bottom keep bruising down and prices up. ●

DONATIONS AND LOANS TO THE DEPARTMENT OF AGRICULTURE

FROM 1 APRIL TO 30 JUNE 1964

To the Agricultural Research Institute, Wagga:

Agserv Industries Pty. Ltd.	1 pt. Bentrol weedicide.
Dow Chemicals (Aust.) Pty. Ltd.	½ gal. Tordon ® revised analysis. 1 gal. Tordon grain formulation.
I.C.I. of Aust. & N.Z. Ltd.	1 gal. Paraquat ®.
Geigy (Aust'asia) Pty. Ltd.	24 oz. Gesagard ®.

To Hawkesbury Agricultural College, Richmond:

David Brown Tractors Pty. Ltd.	1 David Brown 850 Implematic diesel tractor (student instruction). On loan on a permanent basis, being replaced as it is superseded by newer models.
Riverina Stock Feeds Pty. Ltd.	12 sheep feed blocks " Protobloc " (student demonstration).
Imperial Chemical Industries of Aust. & N.Z. Ltd.	2 sheep feed blocks " Uromol " (student demonstration). 1 gal. Diquat herbicide (trial purposes). 1 qt. Paraquat (trial purposes).
W. R. Coventry Pty. Ltd.	100 lb. sheep feed lick (student demonstration). 1 sheep feeding trough (student demonstration).
Nightingale Supply Co. Ltd.	25 gal. Chlorize 13 drums Safene 26 bags Dry Met for cleaning and sanitizing dairy factory equipment.
Nightingale Chemicals (N.S.W.) Pty. Ltd.	20 lb. TCA herbicide (for trial work and general grass control).
Geigy (Aust'asia) Chemicals Pty. Ltd.	4 lb. Gesatop herbicide ® (trial work).
Niagara Chemicals	1 gal. Dicryl herbicide (trial purposes).
Robert Bryce & Co. Ltd.	5 fl. oz. B.V. 201 herbicide (trial purposes).
Agserv Industries Pty. Ltd.	1 pt. Amibeh, herbicide (trial purposes).
Hamilton Horley Pty. Ltd.	4 lb. Linuron (trial purposes).

To the Horticultural Research Station, Narara:

James Hardie & Co. Pty. Ltd.	100 ft. x 6 in. Fibrolite pipe—value £5.—for drainage culvert in Block 19.
Gosford Agricultural & Citrus Assoc.	Cement, sand and metal—value £25, for concrete slabs for Valencia Nutrition Trial.

To the Poultry Research Station, Seven Hills:

Bradford Insulation Industries Pty. Ltd.	44 pieces B1 Fibertex batts Type B.—(for insulation of cage houses.).
Smith Kline & French Laboratories (Aust.) Ltd.	100g. Virgin da mycin premix for chick premixes.
Southern Limestone	2 bags D.D. grade limestone—for poultry feed mixes. 1 bag limestone grit.

To the Agricultural Research Station, Tamworth:

Geigy (A/asia) Pty. Ltd.	1 can Gisagord—value approx. £1.

To the Agricultural Research Station, Bathurst:

Naugatuck Chemical Division of United States Rubber Co.	Experimental chemical B.995. 75g.
Hamilton Horley Pty. Ltd., Highett, Victoria	1 gal. Triton X114. 1 gal. Stero X AJ. 10 lb. Diuron.

To the Agricultural Research Station, Glen Innes:

Australian Fertilizers Ltd.	Supply and application 177 lb. of Anhydrous ammonia (value £11 16s. 9d.) to 1963-4 maize fertilizer trial.

® registered trade name.

To the Agricultural Research Station, Yanco:

Colin Campbell Pty. Ltd.	½ gal. Solan.
New Farm Rural	½ gal. Chloro 1PC.
Monsanto Chemicals (Aust.) Ltd.	5 lb. Randox. 5 lb. Vegidex. ½ lb. CP31393. ½ gal. Averdex herbicide.
Geo. C. Warner Laboratories Pty. Ltd.	1 qt. Carboyne.
Geigy (Aust'/asia) Pty. Ltd.	½ lb. A901. 1 lb. A1404.
Robert Bryce & Co. Ltd.	1 qt. TOK E 25 herbicide.
Rumseys Seeds Pty. Ltd.	Collection of agricultural and veg. materials: 3 display seed pouches. 3 display cans. 1 flower and vegetable catalogue. 1 farm seeds price lists. 6 leaflets " Dry Condition of Seed ".
Wilcox Mofflin Ltd. (Wilmo division)	automatic drenching gun (1 only). 1 1 oz. handpiece, Victor. 1 drencher, handpiece, Victor ACE. 1 kettle gun, Victor Improved. 1 repeater semi automatic. 1 hypodermic syringe. 1 automatic vaccinator.
Andersons Seeds	1 pkt. samples; grasses and clovers
Agserv Industries Pty. Ltd.	assorted literature
C.I.G. Ltd.	60 copies of literature—"Arc Welding for the Farmer."
Horticultural Industries (N.S.W.) Pty. Ltd.	1 Siro Sire ram harness assorted literature.
Grazcos Co-operative Ltd.	2 murals.
Leeton Co-op. Cannery Murrumbidgee Irrigation District Farmers Co-op. Society, Leeton. Arthur Yates & Co. Younghusband Ltd. Farmers & Graziers Ltd' F. D. Mackenzie, Manager, Agric. Research Station, Yanco. James Hardie & Co. Dalgety & N.Z. Loan Commercial Banking Co. of Sydney Ltd.	Donations towards prize list for 1963 Farm Certificate course.

To the South Western Agricultural Region:

Velsicol International Corp. C.A.	1 qt. Banvel D liquid herbicide for trial purposes.
Lane's Pty. Ltd.	16 fl. oz. Saef Dress aerosol for trial purposes.
A. E. Rumsey Pty. Ltd.	3 oz. onion, Cream Gold. 3 oz. onion, Australian Brown. 3 oz. onion, Aust. Brown Creamflesh. 3 oz. onion, No. 103 for vegetable trials.
Griffith Producers Co-op. Pty. Ltd.	3 oz. onion, Early Lockyer-Brown. 3 oz. onion, Early Lockyer-White. 3 oz. onion, Early Grano. 3 oz. onion, Crystal Grano. 3 oz. onion, Hunter River Brown. 3 oz. onion, Hunter River White. 3 oz. onion, White Spanish. 3 oz. onion, Brown Spanish. 3 oz. onion, South Aust. White Globe. 3 oz. onion, Cream Gold. 3 oz. onion, Prizetaker.

To the North Coast Agricultural Region:

Campbell Bros. Ltd.	3 x 7 lb. tins Hysan detergent.
Nambucca River Co-op. Society	Duplication of extension material.
Central Dairying Society	Duplication of extension material.
Nambucca District Council of the Agricultural Bureau of N.S.W.	Bambi Fordigraph duplicator.
Smith Kline & French Laboratories District Representative.	1 doz. tubes nefuran. 1 bottle tablets for calf dysentery.
Amalgamated Chemicals (Qld.) Pty. Ltd.	26 fl. oz. Triton B-1956.
Robert Bryce & Co. Ltd.	18 fl. oz. Triton B-1956. 10 lb. Dithane M45.

To the Mid-Western Agricultural Region:

Bland Trading Company	Long term loan of Gestetner duplicator.
Lanes Pty. Ltd.	Weedicides for district agronomist.
Imperial Chemical Industries of Aust. & N.Z. Ltd.	4 gal. Paraquat.
Oliver & Davidson	1 pt. Embutox for district agronomist.

To the South Coast and Tablelands Agricultural Region:

Goulburn Broadcasting Co. Pty. Ltd.	Continued servicing of tape recorders.
Wright Stephenson Pty. Ltd., Goulburn	10 lb. cocksfoot seed (Mother Grasslands and S. 143).
Wollogorang Pastoral Co. Pty. Ltd., Breadalbane ...	Materials and facilities for pelleting clover seed.

To the Agricultural Research Station, Narrabri:

Howard Rotavators Pty. Ltd.	1 x 70 in. Howard Rotavator (Loan).
Anscott Ginning Pty. Ltd., Narrabri	Ginning, insuring lint, freight, handling and sale of cotton crop. Value approx. £196.

To the Division of Animal Industry:

Cyanamid, Footscray, Victoria	4 x ¼ lb. soluble Aureomycin—for poultry therapy.
May & Baker Pty. Ltd.	1 lb. 40% Emetril ® for treatment of protozoon parasites.
Crookes Laboratories, Ltd.	1 lb. Franomycin ® —feed supplement for poultry disease prevention.
Burroughs Wellcombe & Co. (Aust.) Ltd.	500,000 units—Polymixin B sulphate and zinc Bacitracin for incorporation in media for micro-biological work.
Vitamin Laboratories	1 g. vitamin A alcohol. 5 mg. d-delta Tocopherol for Chromatogenic analyses of vitamins.

To Biology Branch:

Union Carbide Aust. Ltd.	5 oz. TCNA (2, 3, 5, 6 tetrachloro-4-nitroanisole) for experimental work on control of seed-borne diseases of cereals.
Henry H. York & Co. Pty. Ltd.	4 lb. Morocide for experimental work on powdery mildew control.
Agricultural Laboratories Pty. Ltd.	Mettler balance for work in connection with legume inoculant testing.

To the Division of Plant Industry:

Todd & Butler, Mannus via Tumut	50 lb. rape seed, new variety, aphis resistant. (Value approx. £5). In appreciation of assistance received from the Department over the years.
Linseed Crushers' Assoc. of Aust.	1 x 150 lb. bag linseed, var. Calar for experimental purposes (value £6 5s. 0d.).
Bank of N.S.W., Sydney	50 copies of booklets "Pasture Legumes and Grasses" for use of Pastures Section.
A. C. Hatrick Pty. Ltd.	3 lb. Herban ® herbicide for weeds research at Yanco Agricultural Research Station.

To Entomology Branch:

Mobil Oil (Aust.) Pty. Ltd.	1 gal. dipping oil for white wax scale research.
Stauffer Chemical Co. (Aust.) Pty. Ltd.	2 oz. Trithion ® + Imidan ®.
Colin Campbell Pty. Ltd.	1 lb. "Alvit" 90% w/v dieldrin seed dressing.
E. R. Squibb & Sons Pty. Ltd.	1 pt. Strobane 60% w/v. 1 pt. Strobane 40% w/v. + DDT 20% w/v.
Henry H. York & Co. Pty. Ltd.	2 pt. M.A.F.U. ® 50% w/v.

To the Accountant:

Manning District Agric. Research Council, Taree ...	£400 for pasture research in the Manning district.
Sulphide Corp. Pty. Ltd., Boolaroo	£750 for pasture research in Mid Coast and Hunter Region.
Sulphur Institute of U.S.A., 1725K St., North West, Washington D.C., U.S.A.	£1002 15s. 3d. for compilation and publication of results of U.P.S.E.T.
Aust. Fertilizers Ltd.	£750 for pasture research in Mid Coast and Hunter Region.

To Research Stations Branch:

British Motor Corporation	Nuffield "460" Tractor with remote hydraulics—on permanent loan to Wagga Agricultural College.
Port Bros., Morrinsville, New Zealand	Hay Conditioner—on permanent loan to Agricultural Research Station, Grafton.

Livestock Health Notes

DIVISION OF ANIMAL INDUSTRY

UREA CAN BE SUPPLIED AS A LICK

MENTION WAS MADE in last month's notes of the unnecessary administration of mineral licks to stock. One use, however, that can be made of licks is to supply urea to sheep or cattle.

Through the action of bacteria in the rumen, cattle and sheep are able to utilise nitrogen to form protein. Urea both provides this nitrogen and stimulates appetite for dry pasturage and stubble. This effect is augmented by the presence in some blocks of by-products from molasses distillation.

The function of urea licks therefore is to enable more efficient use to be made of poor roughage. Urea is not recommended for stock on green feed or where there is insufficient roughage. Experimental work has shown that stock do better on licks containing more than 20 per cent grain as well as urea.

A point to be noted is that urea can be highly poisonous. It is safe only when ingested slowly and in limited quantities. To restrict intake, licks containing high concentrations of urea need to be extremely hard. Regulations under the Stock Foods and Medicines Act permit licks compressed into solid blocks by heat fusion processes to contain up to 35 per cent urea. Other licks are permitted to contain up to 3 per cent urea.

Even the very hard urea blocks are not safe under all circumstances. Salt-hungry stock may consume excessive quantities. This can be avoided by the provision of salt for some days before urea blocks are put out. There may also be over consumption if the surface of a block has become softened from the effects of rain or prolonged storage. It is advisable, therefore, to inspect blocks not under shelter, during and after rain. Any that show signs of softening should be removed, and can be hardened in the sun for a few days. During prolonged wet periods blocks are best temporarily withdrawn from use. Some urea blocks are only suitable for feeding under shelter. It is necessary always to observe the manufacturer's directions regarding methods of feeding.

If stock are seen to develop symptoms of urea poisoning, the best antidote is vinegar. Dose affected cattle with one bottle of vinegar and one cup of sugar in water. The treatment may be repeated in an hour. The quantity for sheep is approximately one-eighth of the amount for cattle.

CONGENITAL GOITRE FOUND IN LAMBS

CONGENITAL GOITRE was diagnosed during the last lambing season in several flocks on the northern tablelands. It is many years since the condition has been encountered in that area.

The characteristic sign of goitre is an enlargement of the thyroid gland. This gland partly surrounds the windpipe just below the larynx. In congenital goitre, lambs are affected at birth. Goitre can lead to many stillbirths and the death of lambs early in life. In the cases on the northern tablelands mortality was not heavy. Affected lambs which survived the early post-natal period made satisfactory recoveries.

Congenital goitre may be caused by a deficiency of iodine in the soil. It can also occur where the soil content of iodine is normal, but where the pasture contains a factor which interferes with the utilization of iodine by stock. Among the plant species which can act in this way are certain strains of white clover. It was on this type of pasture that these cases occurred.

The finding of goitre on the northern tablelands does not call for the general administration of iodine to sheep in that area. Several years ago quite heavy losses from congenital goitre occurred in lambs in certain flocks in the Goulburn district. The following year a large number of pregnant ewes on affected properties were treated with iodine. A number of the ewes

were left untreated. Goitre did not occur in the lambs born from either the treated sheep, or the untreated ones. Furthermore, even though the use of iodine was abandoned, there have been no cases of goitre in lambs born subsequently.

CATTLE MAY NEED TREATMENT FOR FLUKE

AUTUMN is a period of the year when cattle may need treatment for fluke. Animals having access to swamps in coastal districts are the ones most likely to be affected. Sluggish watercourses on the coast and tablelands, and channels in irrigation areas, may also be sources of fluke. Cattle are rarely affected on well drained land with clearly defined running streams. Symptoms are more often seen on adult stock than in calves. This, of course, is the reverse of what occurs in worm infestation to which young stock are more susceptible than adults.

Treatment is usually effective in removing adult flukes. Recovery from symptoms, however, can be a slow process if good feed is not available. The most widely used drug is hexachloroethane, which is given as a drench. While very efficient, it is not without limitations. One disadvantage is that it taints the milk of dairy cattle for two or three days after administration. Another is that it may be toxic to cattle in advanced pregnancy or early lactation and to cattle showing advanced symptoms of fluke infestation. Where it is necessary to treat such cattle, greater safety can be secured by dividing the dose and giving a portion on each of two or three successive days.

Another drug that has been used for treatment is carbon tetrachloride. It has, however, the reputation of not being wholly safe when used as a drench. Deep intramuscular injection is said to be a less risky mode of administration. Even this technique has its shortcomings as it can give rise to very painful swellings where the needle went in.

Yet another preparation that may be used is hexachlorophene. It also has good efficiency. However, there have been the odd reports of deaths from toxicity following its use.

A consideration worth noting is that fluke larvae younger than six weeks are little affected by commonly used drugs.

NEW WAY TO CONTROL KIDNEY WORMS

ON MANY PIG FARMS, kidney worms cause considerable economic loss. Much of this loss passes unnoticed. Infestations by the larvae of this worm lead to retarded growth rate and delayed finishing of young pigs. At times these effects can be quite marked, and deaths occur. The infective larvae hatch from eggs which are spread by adult pigs carrying mature worms in the kidneys. Control of this parasite has been difficult in the past because there are no drugs capable of removing kidney worms.

Recently in the United States there has been developed the "gilt only" method of control. Under this system all but virgin stock are sent for slaughter. Breeding is then undertaken exclusively by first litter sows and young boars. Limited observations have suggested that infestation may be eliminated or reduced to such low levels after about eighteen months, that normal husbandry practices can be resumed. During the control period, sows are bred sufficiently early to permit weaning of the litter and slaughter of sow at about 12 months of age. Boars also are not kept beyond that age.

This method of control is possible because kidney worms take 10 to 12 months to reach the egg-laying stage.

When egg-laying is prevented, further spread ceases. The breeding from virgin sows is therefore carried on for the time required for worm eggs on the ground to die out. Few of these eggs remain infective after about six months.

While this method would involve a temporary radical change in husbandry, it could be well worth consideration where kidney worms are a problem.

Poultry Should Have Vitamin A All Year

Vitamin A is essential for healthy poultry growth and should be available all year round. It is obtained from green feed and vitamin A supplements.

Deficiency diseases are rare among flocks kept under good conditions when suitable green feed is available in regular and adequate amounts. Fresh green feed is a satisfactory source of vitamin A and, to a lesser extent of riboflavin.

Fish oils or synthetic vitamin A powders are essential if green feed is not available.

Vitamin A exists in plant tissues in the form of carotene. This substance is changed into vitamin A in the bird's liver.

Vitamin A is readily stored in the liver and lowered intake of the vitamin over a short period is rarely harmful.

Care of chickens

Chickens cannot store vitamin A for as long as adult fowls. For this reason, when vitamin A intake is cut off deficiency diseases appear in chickens sooner than in adult fowls.

BOOK REVIEW

An Introduction to Tropical Grassland Husbandry, *R. J. McIlroy. London: Oxford University Press,* 1964. **x + 128 pp., 26s. 6d.**

F. G. Swain and J. G. Bird of the Agricultural Research Station, Wollongbar, have provided the review.

An Introduction to Tropical Grassland Husbandry has been written for students and others who require a broad but, necessarily, highly compressed review of its subject. In addition to fulfilling this aim the book highlights, by its frequency of reference to research on temperate grasslands, the urgency of continued emphasis on the need for research into tropical grassland problems.

The book is divided into fourteen chapters dealing with the economic value of grassland; the nature of grasses; the agricultural value of herbage species; some grass and legume species of tropical regions; some tropical grassland associations; types of grazing pasture; seed production; seeds mixtures; establishment of the sward; management and manuring; grassland utilization; grassland improvement; the nutritive value of tropical pasture grasses and legumes; conservation and the measurement of grassland productivity. Appendices by G. Jackson, of the University of Ibadan. discuss the ecological basis of grassland husbandry and the grasslands of tropical Africa. There is a bibliography and an index. But the bibliography is certainly not indicative of the volume of tropical pasture research carried out in Australia.

It is unfortunate that so little reference is made to Australian tropical pasture research, particularly as some of the more detailed work in evolving new principles has been carried out by Australian workers.

Dr. William Davies, in a foreword to the book, broadly accepts that temperate grassland principles can be applied with little modification. With expanded research activity in the tropics this assumption, and implicitly the value of Professor McIlroy's book, will be put to critical test. ●

RESEARCH SECTION

SUBTERRANEAN CLOVER ESTABLISHMENT AND NODULATION TRIALS

HUNTER VALLEY Research Agronomist, R. S. Wetherall, has reported results of subterranean clover establishment and nodulation trials on acid soils at Dunn's Creek, near Paterson, and Rothbury, near Branxton. The trials compared the effects of drilled and broadcast superphosphate and of several rates of lime application.

At both sites, a grey sandy top soil, 3 to 6 inches deep, with pH 5.0 to 5.2, over-lies a clay subsoil. Clare subterranean clover was sown at 5 lb. per acre in prepared seedbeds in drills 12 inches apart. Sowings were made in July. In all except the control plots, the seed was inoculated with a commercial peat culture at stan-

® Registered trade name.

Percentage of subterranean clover plants showing crown nodulation

Lime Treatment	Dunn's Creek				Rothbury			
	Superphosphate broadcast		Superphosphate drilled		Superphosphate broadcast		Superphosphate drilled	
	per cent		per cent		per cent		per cent	
No inoculum, no lime	3·7	(11·1°)	0·4	(3·8°)	18·9	(25·8°)	10·9	(19·3°)
Inoculated, no lime	5·5	(13·5°)	3·0	(10°)	23·3	(28·9°)	13·9	(21·9°)
Inoculated, lime pelleted	83·1	(65·7°)	58·4	(49·8°)	48·0	(43·9°)	55·1	(47·9°)
Inoculated, 2 cwt. lime drilled	44·0	(41·6°)	....		36·2	(37·0°)	....	
Inoculated, 4 cwt. lime drilled	66·9	(54·8°)	54·4	(47·5°)	29·4	(32·8°)	40·8	(39·7°)
Inoculated, 1 ton lime broadcast ...	81·6	(64·6°)	83·8	(66·3°)	43·9	(41·5°)	74·8	(59·9°)
Inoculated, 2 tons lime broadcast ...	89·0	(70·6°)	....		58·4	(49·8°)	....	
Difference necessary for significance ..	11·51°				15·75°			

dard rates applied by the slurry method. In the lime pelleted treatments, peat inoculum was mixed with a 5 per cent solution of Cellofas A®, mixed with the seed, and the seed then coated with whiting (a very fine form of lime).

Molybdenised superphosphate at 4 cwt. per acre was applied to all plots. In half the plots it was drilled with the seed and in the others it was broadcast after the seed was drilled. Lime treatments included pelleting, 2 and 4 cwt. per acre drilled, and 1 and 2 tons per acre broadcast and worked into the surface soil two months before sowing.

Germination

Germination was reduced when superphosphate was drilled with the seed. At Dunn's Creek 48 per cent of the viable seeds produced seedlings on broadcast superphosphate plots and 31 per cent produced seedlings on the drilled superphosphate plots. At Rothbury the corresponding results were 62 per cent and 43 per cent. Dry weather delayed germination at Dunn's Creek and the number of seedlings was low. Conditions were better at Rothbury.

Nodulation

Seven weeks after sowing at Rothbury and eight weeks after sowing at Dunn's Creek, 25 random plants were taken from each plot and the number of plants with nodules on the crown were counted.

There was little difference between drilled and broadcast superphosphate treatments in the percentage of plants nodulated. Drilling the superphosphate with the seed tended to increase nodulation if the plots also received lime, but where the plots received no lime, nodulation seemed poorer on the drilled superphosphate plots than on the broadcast plots.

Heavy rates of broadcast lime (1 and 2 tons per acre) and lime pelleting after inoculation gave the best results. These treatments were much more effective than 2 and 4 cwt. of lime drilled with the seed (see table). In practice, lime pelleting is preferred because it is cheap and effective.

Soil pH

At Dunn's Creek the heavy rates of lime (2 tons per acre) raised the pH of the surface inch of soil from 5.2 to 7.0, whilst pH of the 2 to 3 inch depth remained unchanged at 5.6. At Rothbury heavy liming changed the pH of the top inch from 5.1 to 6.8, the second inch from 5.0 to 6.3 and the third inch from 5.0 to 6.2. The greater effect at Rothbury is mostly the result of deeper working, and also partly of lighter soil texture. ●

INSECTS ON COTTON CROPS

A LIST OF INSECTS recorded on irrigated cotton crops in New South Wales between December, 1959, and May, 1964, is published in the December, 1964, issue of the *Australian Journal of Science* (Vol. 27, pp. 178-9). The list was compiled by W. E. Wright and M. I. Nikitin of the Entomology Branch. They collected insects from cotton crops at the Agricultural Research Station, Narrabri, and at Yanco, Leeton, Barham, Euston and Rydalmere between 1959 and 1964. Of the 49 species collected, 31 were classified as injurious and 18 as beneficial.

The previous comprehensive listing of insect pests of cotton by a member of the Entomology Branch was in 1923 and 1924. At that time interest in cotton had been stimulated by the high price of cotton fibre, and trial areas were sown in many parts of the State. W. B. Gurney, Government Entomologist, described some of the insects known to attack cotton and discussed control measures. In the first of a series of articles beginning in Volume 34, Part 12, of the *Agricultural Gazette* Mr. Gurney said that "upwards of 30" insects had already been recorded as attacking cotton in New South Wales, but he did not list them all.

Common bollworm (*Heliothis* spp.) and rough bollworm (*Earias huegeli*), the major insect pests of cotton, were described in the 1923-24 articles, but were not as important then as the yellow maize or cotton moth (*Dichocrocis punctiferalis*) and the Monolepta beetle (*Monolepta* (*rosea*) *australis*). The yellow maize moth and the Monolepta beetle are not recorded in the recent list, probably because it was mainly compiled from collections on commercial irrigated, inland cotton. Much of the collecting in the earlier period was done on small trial plots on the north coast where cotton was considered a promising crop. ●

SOIL PHOSPHORUS

IT HAS BEEN generally accepted that, on acid soils, aluminium phosphates supply soluble phosphorus to the plant more readily than do iron or calcium phosphates. A. N. Smith of the Agricultural Research Institute, Wagga Wagga, has now demonstrated that a wheat plant obtains most of its phosphorus from the aluminium phosphates. The experiment was with a slightly acid red-brown earth.

During the 82 days of the experiment the quantity of iron phosphates increased in an uncropped treatment, suggesting that some phosphate moved from the aluminium to the iron fraction. In the treatment with the crop there was no significant increase in the iron phosphates fraction. The crop may have drawn some of its requirement from the iron phosphates or may have competed with the iron phosphates for soluble phosphate released by the aluminium fraction.

Mr. Smith's results are another advance in the effort to understand the relative importance of the different forms of soil phosphorus in plant nutrition. The paper on this work is published in *Plant and Soil.* ●

SOIL TESTS IN WASHINGTON STATE, U.S.A.

THE VISIT to Australia in the later part of 1964 of Dr. A. R. Halvorson, extension specialist in soil testing at Washington State University, U.S.A., was welcomed by the chemists concerned with soil tests and fertilizer recommendations. Soil testing is a well-established aid in fertilizer advice in Washington State.

Dr. Halvorson emphasised that, even with long experience of soil testing, it is not claimed that a precise amount of fertilizer can be recommended. Field trials provide an initial indication of the fertilizer needs of different soil types in a district. Soil tests then allow a closer estimate of the most profitable fertilizer application rate for the paddock tested. The fertilizer recommendation based on the soil test is still not a precise figure. For example, the recommendation would be to apply between 200 and 300 lb. superphosphate on a soil rated as of medium phosphate level. The farmer understands that a more precise estimate is not possible and chooses his application rate from within the recommended range.

In Washington State, soils are classed as very low, low, medium or high on the basis of phosphorus test results, and the amount of fertilizer recommended depends on the class. This system has much in common with the three stage classification adopted by J. Bradley and R. W. Fitzsimmons in their report on the wheat uniform fertilizer trial results (*Agricultural Gazette,* December, 1964, pp. 1487-97).

Nitrogen

Dr. Halvorson's comments on soil nitrogen testing were particularly useful at the present stage of research into the possibility of using nitrogen tests for advice to wheat growers in New South Wales.

There are complexities in the use of nitrogen fertilizers on wheat apart from their relatively high cost. For example, the soil nitrogen level can be too high in some circumstances. In a dry season in the south-west, a wheat crop that follows a period of subterranean clover pasture may grow well but hay-off as moisture becomes limiting, and the crop may not be as profitable as one on a soil with less nitrogen. The effect of nitrogen fertilizer would be similar to the effect of nitrogen accumulated by a subterranean clover pasture.

Field trial results and rainfall records are used to divide Washington State into areas differing in potential response to nitrogen fertilizer. This division is a very broad guide to the amount of fertilizer to apply. It can be narrowed for a particular paddock or season by soil tests. Winter wheat varieties are sown and become established in the autumn and are almost dormant through the winter. The winter rainfall is good but the summer is usually dry so the yield largely depends on the quantity of moisture present in the soil when the crop begins to grow actively in the spring. Tests for soil moisture made at this time are considered in conjunction with soil nitrogen tests in deciding the fertilizer rates to be recommended. As with phosphorus the soil testing service recommends an upper and lower limit for the amount of fertilizer to be applied, leaving

the farmer to decide the exact amount.

The conditions in Washington State make the calculation of probable returns from nitrogen fertilizers a good deal easier than in New South Wales. Our wheat crop depends much more on the rain that falls during the later part of the growing period.

A decision about nitrogen fertilizer rates has to be made well before the total amount of moisture that will be available for the crop can be known. The rainfall is so erratic that only a very general estimate would be possible of the rain still to come and, therefore, of the amount of nitrogen the crop could use profitably.

Need to re-calibrate

One other aspect of soil testing stressed by Dr. Halvorson was the necessity to continue field trials after the initial standards have been set, so that the tests can be made more precise and re-calibrated as farming practices, fertility levels and crop varieties change. •

BOOK REVIEW

THE PRINCIPLES AND PRACTICE OF AGRICULTURAL RESEARCH, *S. C. Salmon and A. A. Hanson.* 1964. *Leonard Hill, London.* XI + 384 pages. Price 75s. (Stg.).

The reviewer is Dr. W. V. Single, Director of Research, Agricultural Research Station, Tamworth.

RESEARCH WORKERS in the field of agriculture will be well aware that while the "principles" of agricultural research may perhaps be treated in a single volume, its "practice" already fills more journals than the average investigator can even scan. The authors of *The Principles and Practice of Agricultural Research* freely admit this, and have only treated in detail those sections with which their very considerable experience has made them familiar. The result is a book which, while having particular appeal to those engaged in research with field crops, has something to offer to all who have enthusiasm for agriculture, whether farmers, students or administrators.

Parts I and II, on the history and philosophy of research, cover a wide field and bring together much interesting material which the student may otherwise miss. The title of Chapter VII "Why Errors Occur" sets the pattern for many of the authors' ideas in this and later sections.

Chapters on statistical methods are clearly and logically set out. Value here lies rather in the general approach to the use of these techniques than in their actual description, as this is available from several standard texts. It is unfortunate that the growing impact of high speed computers on the treatment of data, and on the design of experiments, is given only passing mention.

The treatment of field plot technique is clearly the product of two very experienced investigators and must be of value to any worker concerned with such problems. Questions of plot size and management are considered from the practical as well as the theoretical point of view, and students in particular will gain from sharing in the authors' wide knowledge of the pitfalls awaiting experimenters with field crops.

Chapters dealing with economics and with experiments with animals are presented in less detail. Australian readers will be disappointed that no reference is made to recent contributions to techniques in livestock research by workers in this country. In fact, no references to any work since 1960 have been cited, so even the subjects which have been treated in some detail are to this extent out of date.

The book is well set out on good paper and attractively bound. Two fairly obvious errors mar the early parts of the statistical section, but otherwise the printing is good. There is a useful index and some abbreviated statistical tables.

Only one really valid criticism of the text can be maintained. In setting out to cover too wide a field, the authors have included much material which is already available to most students and research workers. This is not a bad thing in itself, but must contribute to the rather high price. It would be a great pity if this had the effect of reducing the number of people who might read and enjoy the real contribution made by S. C. Salmon and A. A. Hanson to agricultural research, with this volume. •

Control of Banana Rust Thrips

(*Scirtothrips signipennis* Bagn.)

B. M. Braithwaite

SUMMARY

A series of spraying and dusting experiments with insecticides for the control of banana rust thrips (Scirtothrips signipennis) *is described.*

Dieldrin, DDT, lindane, malathion, BHC and demeton as sprays and dieldrin, aldrin, lindane, BHC and BHC plus DDT as dusts were tested. Sprays were applied to bunches, stems and foliage at about monthly intervals from November to March, the period of maximum activity of the pest. Dusts were applied to bunches at weekly and fortnightly intervals from emergence in an effectiveness, time and frequency study.

Fruit treated with dieldrin dust or spray was superior in market quality to fruit from other treatments, but the other treatments also gave satisfactory control of rust thrips. Dieldrin sprays reduced banana beetle borer (Cosmopolites sordidus) *numbers for some months and did not cause increases of red spider* (Tetranychus lambi) *populations.*

Banana rust thrips (*Scirtothrips signipennis* Bagn.) feeds on the skin of the banana fruit and causes a reddish-brown blemish. It was first recorded in New South Wales in 1920 by Tryon (Girault, 1925) in the Tweed River district and now occurs in the Tweed and Brunswick districts but has not been recorded on bananas elsewhere in New South Wales.

The control of banana rust thrips has received considerable attention in Queensland, where it is a more serious pest than in New South Wales. Smith (1947) recommended a minimum of four fortnightly dustings of bunches with DDT in south-eastern Queensland, and Smith and Weddell (1949) four fortnightly dustings with DDT, BHC or BHC plus DDT with a preference for DDT. Saunders (1961) recommended the treatment of bunches with a composite dust containing BHC and DDT or a spray containing 0.1 per cent DDT for rust thrips and scab moth (*Nacoleia octasema* (Meyr.)) control in tropical north Queensland.

During the early 1950's control of banana rust thrips in New South Wales was based on DDT as a dust applied to bunches or as a spray applied to whole plants. DDT dusts or sprays reduced rust thrips populations, but sprays applied to whole plants reduced the populations of Coccinellid predators (*Stethorus vagans* Blackb.) and caused major increases of red spider (*Tetranychus lambi* Pritchard and Baker) on foliage. Reduction in predators also followed dusting unless particular care was taken in application.

The experiments described in this paper were to test other insecticides for rust thrips control and to observe the effect on predators of red spider.

EXPERIMENTAL PROCEDURE

Spraying experiments (1 to 4)

Plots of experiment 1 were of single plants about to bunch. The other experiments were in randomised blocks. The size of plots for experiments 2 to 4 varied with the spacing of plants, and averaged 60 x 30 ft. and contained about 30 plants. A programme of sprays was applied to protect bunches emerging during November to March, the period of maximum thrips activity in the northern banana areas of New South Wales. Insecticides were applied as complete cover sprays at the first application. In subsequent sprays only new leaves were treated. A fungicide was used with each insecticide to control leaf spot (*Mycosphaerella musicola* Leach). Spray materials were applied at a pump pressure of 200 to 250 lb. per square inch.

Dusting experiments (5 to 7)

Bunches for treatment were selected at random in plantations, each bunched plant representing a single plot. Dusts were applied with knapsack

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dusters to bunches and bunch stalks only. Treatment usually began as bunches emerged and was repeated several times at weekly or fortnightly intervals.

Assessment of effectiveness

Effectiveness of treatments was assessed by examining bunches for rust thrips injury at harvest.

Individual fruits were removed from bunches in the packing shed and rated for skin injury as follows: 0 = no injury; 1 = 0-25 per cent; 2 = 26-50 per cent; 3 = 51-75 per cent; 4 = 76-100 per cent skin injury.

For each treatment, total rust ratings and then the average rust rating per fruit were calculated according to the method of Caldwell (1938).

SPRAYING EXPERIMENTS

Experiment 1, 1953-4, Burringbar, 6 treatments, 5 randomised blocks

Emulsifiable concentrate formulations of DDT, BHC, dieldrin, malathion and demeton were used in a preliminary screening of insecticides. Bordeaux mixture was included with each insecticide for disease control and sulphur was added to DDT, BHC and dieldrin sprays for red spider control. Treatments were applied on October 21, November 25, December 16 and February 2. Bunches were harvested from January to April and were assessed for rust thrips injury.

The destruction of many bunches by a storm prevented a full evaluation of the insecticides, but dieldrin gave promising control. Fruit of dieldrin treated bunches was superior in appearance to fruit from other treatments, which had many minor blemishes in addition to rust thrips injury.

Experiment 2, 1954-5, Burringbar, 3 treatments, 5 randomised blocks

A wettable powder DDT and an emulsifiable concentrate formulation of dieldrin were used. Insecticides were applied on October 20, November 15, December 14, January 13 and February 14. Bordeaux mixture was added to each insecticide for disease control. Rust thrips populations behind leaf bases on pseudostems were low throughout the experiment in all treatments. Bunches that emerged during the period of spraying were labelled and assessed for rust thrips injury at harvest (table 1).

Experiment 3, 1954-5, Condong, 4 treatments, 4 randomised blocks

Emulsifiable concentrates of dieldrin and malathion and a wettable powder formulation of DDT were used. Insecticides were applied on October 26, November 17, December 14, January 11 and February 10. Copper oxychloride was added to each insecticide for disease control. Rust thrips numbers were low on pseudostems in all treatments throughout the experiment. Bunches emerging during the period of spraying were labelled and assessed at harvest for rust thrips injury (table 1).

Populations of thrips were low during experiments 2 and 3. Dieldrin was superior to DDT and malathion but the three insecticides gave satisfactory control. Improved appearance of dieldrin treated fruit was again observed.

Experiment 4, 1955-6, Clothier's Creek, 5 treatments, 4 randomised blocks

Further work with DDT, malathion and dieldrin was undertaken in 1955-6. Lindane was also tested. DDT and malathion were used as wettable powders, and dieldrin and lindane as emulsifiable concentrates. Insecticides were applied on December 6, January 4 and February 1. Zineb was included with each insecticide for disease control and was also applied alone to all plots on March 8. Rust thrips numbers were high behind three randomly selected leaf bases of pseudostems in control plots at each weekly observation from December to March: thrips numbers exceeded 50 on each occasion. No thrips were seen on dieldrin or lindane treated plots at any time and a total of 41 thrips were counted on DDT and 65 on malathion treated plants at 12 observations (three plants in each) over the four months period. Bunches emerging during the period of spraying were labelled and assessed for rust thrips injury at harvest (table 1).

All insecticides prevented serious thrips injury to fruit,

Table 1. Effectiveness of spray formulations of insecticides against rust thrips

Treatment	Average rust rating per fruit		
	Expt. 2	Expt. 3	Expt. 4
dieldrin 0·05%	0·004	0·01	0·16
DDT 0·1%	0·01	0·02	0·50
malathion 0·05%		0·04	0·67
lindane 0·03%			0·45
control	0·02	0·09	1·52

but they differed considerably in their capacity to prevent minor blemish. Dieldrin was superior to the other insecticides in this regard.

The incidence of red spider (*T. lambi*) on leaves was assessed in January, February and March. Mites were counted on a pre-determined section of the second youngest leaf. Populations of red spider on DDT sprayed plants were high but were not serious on plants of any other treatment (table 2).

Numbers of banana beetle borer (*Cosmopolites sordidus* Germ.) were estimated in each plot on five occasions by counting the weevils attracted to unbaited traps (2 in. transverse sections of pseudostems) in the plots (table 3). Only dieldrin reduced banana beetle borer numbers. Dieldrin controlled beetle borer throughout the period of three months that sprays were applied and for three months after spraying.

DUSTING EXPERIMENTS

Experiment 5, 1955, Clothier's Creek, 7 treatments, 6 replications, randomised

This preliminary screening of insecticidal dusts began in April, 1955. Rust thrips incidence was high on bunches and pseudostems despite the lateness of the season. Insecticides tested were dieldrin, aldrin, DDT, lindane and DDT plus BHC (two strengths). Bunches were first dusted before the flower bracts fell. On three replicates the first dusting was on April 14 and on the other three on April 21. Dusts were applied four times in all, three times at weekly intervals and once after a further two weeks. Bunches were harvested in August and September and were assessed for rust thrips injury (table 4).

Table 2. Incidence of red spider (*T. lambi*) on foliage, after application of insecticides for rust thrips control, experiment 4.

Treatment	Number of red spiders on section of second youngest leaf (12 observations per treatment)							
	No. days after insecticide applied							
	7	17	27	14	22	29	49	56
control	10	10	0	8	4	8	0	10
dieldrin 0·05% ...	4	2	10	0	30	10	22	0
lindane 0·03% ...	0	20	0	16	10	2	36	12
malathion 0·05%	8	102	0	36	0	4	6	0
DDT 0·1% ..	194	302	190	388	260	126	100	30

Table 3. Incidence of banana beetle borer (*C. sordidus*) in plots, after application of insecticides for rust thrips control, experiment 4.

Treatment	Number of beetles trapped at 2 in. sections of pseudostem placed in plots (16 traps per treatment)				
	No. months after insecticide applied				
	1	2	3	5	6
dieldrin 0·05% ...	4	7	5	16	11
DDT 0·1% ...	16	33	56	39	17
lindane 0·03% ..	28	54	65	39	26
malathion 0·05%	26	65	85	38	16
control	35	56	83	53	15

Table 4. Effectiveness of dust formulations of insecticides against rust thrips.

Treatment	Average rust rating per fruit	
	Expt. 5	Expt. 6
dieldrin 2% ...	0·02	
dieldrin 1% ...		0·02
lindane 1%	0·01	0·03
DDT 1% + BHC 1%	0·01	
DDT 1% + BHC 3%	0·02	
DDT 2% + BHC 4%		0·12
aldrin 2%	0·02	0·05
BHC 4%		0·03
DDT 2%	0·28	0·10
control	1·51	1·72

All insecticides except DDT gave very satisfactory control of rust thrips. DDT dusted fruit carried considerable minor blemish and was unattractive in appearance. Injury to untreated bunches was severe.

Experiment 6, 1956, Clothier's Creek, 7 treatments, 5 replications, randomised

The insecticides used in 1955 were tested again in this experiment but BHC was also included and the percentage active ingredient in some dusts was slightly different. Bunches of two replications were dusted for the first time on February 14, two on March 1 and one on March 15. Bunches were dusted four times at fortnightly intervals, the first applications of dusts being applied as bunches appeared in the throats of plants. Bunches were harvested during May to August and were rated for rust thrips injury (table 4).

Bunches were adequately protected from rust thrips injury by all insecticides including DDT which gave unsatisfactory results in experiment 5. As in the spraying experiments, fruit treated with dieldrin had a better appearance than fruit treated with other insecticides. BHC, at the concentration tested, imparted an undesirable flavour to fruit.

Experiment 7, 1956, Clothier's Creek, 9 treatments, 5 replications, randomised

The objective in this experiment was to determine the best time for the first application of dust to bunches and to compare weekly and fortnightly dust treatments. Bunches were treated with 2 per cent dieldrin dust in the following stages of development: "cob" stage: bunch upright in throat of plant, bracts tightly closed around fruit; "late cob" stage: bunch fully emerged and pendant, bracts beginning to lift from fruit; "bracts open" stage: bracts lifted and curling backwards from hands to expose fruit; and "bracts fallen" stage: bracts fallen or dead and still attached to bunch, fruit completely exposed.

There were nine treatments: one at each of the four stages of bunch development with three dustings at fortnightly intervals after the first; the four stages with seven dustings at weekly intervals after the first; and the control. Dieldrin was first applied to bunches as they became available over the period February 23 to March 15. Harvesting was from May to August and fruit was assessed for rust thrips injury when bunches were cut (table 5).

Rust thrips control was excellent in all treatments, indicating that very early dusting is not essential with dieldrin.

Table 5. Best time of application of dieldrin 2 per cent dust for control of rust thrips, experiment 7.

Stage of Application	Average rust rating per fruit
cob stage—	
weekly	0·02
fortnightly	0·03
late cob stage—	
weekly	0·01
fortnightly	0·03
bracts opening stage—	
weekly	0·03
fortnightly	0·01
bracts fallen stage—	
weekly	0·08
fortnightly	0·10
control	1·72

More minor injury occurred on fruit where the initial dusting was delayed, suggesting that the first applications of dusts should be made before bracts fall. The effectiveness of fortnightly dusting with dieldrin was confirmed in this experiment.

DISCUSSION

Both spray and dust formulations of dieldrin protected fruit from rust thrips injury (tables 1, 4). Moreover, dieldrin sprays did not cause a build-up of red spider (table 2) and gave some protection against banana beetle borer (table 3). Dieldrin treated fruit had an excellent appearance and generally a better market quality than fruit treated with other insecticides. The reason for the better appearance of dieldrin treated fruit is not known but perhaps it resulted from control of casual pests which cause minor blemish.

In general, DDT spraying or dusting gave adequate rust thrips control (tables 1, 4), but was inferior to dieldrin treatments. In addition, DDT sprays drastically reduced the Coccinellid predator population and allowed an upsurge of red spider numbers on foliage. The effect of dusting bunches on Coccinellid populations was not determined but, with careful dusting in these experiments, no increase in mite numbers resulted.

Lindane and malathion sprays were comparable to DDT in rust thrips control (table 1) and had an advantage over DDT in effect on red spider populations (table 2).

Demeton was tested in a preliminary screening experiment (expt. 1), but was not further assessed despite indications of promise against rust thrips. It was difficult to foresee any possibility of applying demeton safely in banana plantations where plants are grown close together and the overhead canopy of foliage is dense.

Aldrin, BHC, lindane and BHC plus DDT dusts, applied at four fortnightly intervals, reduced rust thrips damage to fruit and were comparable in effectiveness with dieldrin dusts (table 4). BHC, used alone or in combination with DDT at concentrations of 3 or 4 per cent, tainted fruit, but lower concentration BHC dusts did not have this characteristic. Experiment 7 suggested that the first application of dust should be made before the bracts fall and that four dustings with dieldrin, at fortnightly intervals, is sufficient (table 5).

These results are the basis of the recommendations for the control of banana rust thrips in New South Wales (Braithwaite, 1963). The value of dieldrin for rust thrips control has been widely recognised since the inception of the work in 1955 and it is used almost to the exclusion of the other recommended insecticides. There has been a decided change to spraying in

recent years and dusts are seldom used.

In the recommended spray control programme, the interval between treatments is six weeks, based on the experiments reported, and no problem should arise with toxic residues of insecticides on fruit. The recommended intervals in New South Wales between the last insecticide treatment and harvest are 40 days for dieldrin, 30 days for lindane and 7 days for malathion (Hely and Gellatley, 1964). Although emergence of bunches is continuous, bunches close to harvest need not be sprayed as most rust thrips injury occurs on young fruit in the first two months of its development. Dusting is also unlikely to raise residue problems, because bunches are not harvested for at least six weeks after the last dusting.

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The Farm Home

On Building a Rockery

M. Watson

ROCKERIES should be made to appear as natural as possible and for this reason flat sites are obviously unsuitable. Rockeries constructed on flat sites have a disconnected atmosphere about them. The more rugged sloping areas are ideal, and present many possibilities.

Once the site has been chosen, a closer inspection will be necessary to ensure that the area is free from any of the bad perennial weeds or grasses such as oxalis, onion weed or couch grass. If these weeds are present, thorough eradication over a suitable period beforehand will be essential or preferably another site chosen. Once the rockery is constructed it is hard to eradicate these weeds.

The next step would be to examine the question of drainage. The base should be constructed to allow the free passage of water beneath the rockery to avoid wet areas at lower levels. Also any surface water that would normally flow over this area would need to be caught at the top and diverted past the rockery. The last precaution is essential to prevent the constant erosion that would obviously follow. Furthermore the soil that is used should be sufficiently open in texture to allow the free passage of water through it.

The soil should also be of good quality as it is difficult to incorporate other materials at a later date.

When choosing the stone it is desirable to use that which is found occurring naturally in your area. The best effects are gained from the use of well weathered and rather rugged stones of good size. The size of the stones will obviously depend on the size of the rockery, but refrain from using large quantities of small material.

The final step is the building of the rockery. This requires appreciation of the material being used, and its placement. The stones should be placed on well consolidated soil and arranged to give bays and pockets at different and irregular levels. The stones should be laid flat with a fair proportion of the rear section covered, for reasons of stability and to blend them into the rockery.

Only experience and understanding can produce the best effect, but observance of these points will eliminate many of the obvious errors we see so often. ●

The Author: Mr. M. Watson, Landscape Designer, Royal Botanic Gardens, Sydney.

*Death by Falling**

PUBLIC HEALTH DEPARTMENT

TWO HUNDRED AND THIRTY-SIX men and women over the age of sixty years died from falls during 1962 in New South Wales.

The trend in recent years has been that falls are the greatest accident risk to the elderly, particularly in the case of elderly women.

Elderly people are highly susceptible to fatal complications as the result of a fall. Because fractures take so much longer to mend in an elderly person, and also because of poor circulation a lengthy period of immobility ensues which may lead to serious complications and perhaps death.

Advancing public health in most countries of the world has improved life expectancy and, as a result, falls in the increasing proportion of elderly people have become quite a problem. How, then, can we help the older person to live out his life without the added burden of pain caused by unnecessary falls?

Following close investigations of this problem, safety experts say that the majority of falls occurring to the elderly could have been foreseen and prevented. It is instructive to study what these investigators have found to be the main reasons for falls of elderly people.

BEDROOMS. It may be surprising to learn that it is in the bedroom where most falls occur. Many can be attributed to getting out of bed too fast; here the elderly person may have a momentary blackout, and fall. Tripping over shoes, rugs, chairs or lamp cord accounts for a number of falls. When getting up, the elderly person should sit on the edge of the bed for a few minutes. Another thing to be avoided in the bedroom is getting up at night without turning on the light. If the light switch is not handy then a torch should be kept close at hand.

BATHROOMS. The best and sprightliest of us have trouble at times keeping our equilibrium in the bathroom. Here is another serious danger spot for the senior citizen and many fatalities occur as he is getting in, getting out, or getting down in the bath. To prevent this a non-slip rubber mat should be placed on the bottom of the bathtub or shower. Handgrips should be installed in the bathroom or shower recess so that the occupant can hold on with one hand while he is soaping or rinsing with the other. Another suggestion is a similar handgrip on the wall near the toilet.

* Reprinted from *Health in New South Wales*, May, 1964, Vol. 5 No. 2, pages 10-11.

CLIMBING STAIRS AND CLIMBING ON CHAIRS. Aged people who are unsteady on their feet should place both feet on a stair tread before proceeding to the next one, while going up or down stairs. It is also imperative that stairways used by elderly people should at all times be well lit. Falls often result from elderly people climbing on chairs to replace light bulbs or hang curtains. Aged and infirm people should simply not do these things, although circumstances which result in them being alone are a constant temptation, coupled with a denial of their own limitations.

TAKING A STEP. The muscles and ligaments of elderly people, having naturally enough lost their spring, prevent them lifting their feet as high or as quickly. Accidents subsequently happen from tripping over small things such as toys, doormats, rug covers, etc. The elderly person if unsure of his footing should never take a step backwards, particularly on lawns, driveways, or anywhere that the surface is uneven or unfamiliar.

When we slip and start to fall certain muscles in our body immediately go into action to try to keep us on our feet. In later years this counter balance does not function as efficiently and, consequently, there are more falls and more severe injuries. The chart below shows the susceptibility to falls as the years increase.

Dr. Hugo Droller, an English physician, suggests that besides educating our aged citizens in studying "senior age safety" that we also stress the importance of physical fitness. It is his contention that protection against falls in old age may well lie in physical training that continues through life. This is borne out by the number of men in their 70's who still score in the 70's at golf—or the bowler who is still trundling them down as well as ever in his eightieth year.

For safety underfoot for the whole family these pointers from the National Safety Council of Australia should be kept in mind.

- Keep bare floors in good repair and free from uneven or rough areas, loosened tiles, wide cracks, etc.
- Repair or replace floor coverings which have tears or holes, or loose, frayed or curled edges.
- Wipe up spilled liquids, foods, grease, etc., from floors promptly.
- Keep floor cloths or paper towels near all work centres where liquids may be spilled.
- Pick up hairpins, rubber bands, paper clips and other articles dropped on floors.
- Keep out of traffic lanes any objects that are likely to trip or be stumbled over.
- Keep toys, sewing boxes and other small articles off the floor.
- Use a non-slip device under small rugs —rubber pads, a rubberised coating, etc.
- Provide adequate and permanent lighting in dark storage places.

DEATHS FROM FALLS IN N.S.W., 1962

Age groups	Males	Females
60-64	12	3
65-69	7	12
70-74	18	22
75-79	11	32
80-84	22	65
85-90	5	20
90-94	—	6
95-99	—	1

A Child's Toy You Can Make

NINA MARTINDALE

SOFT TOYS are always popular with small children. You're sure to know some child who would be delighted with this kangaroo and joey you can make. You'll need:

- Cardboard (thin and pliable);
- paste;
- felt;
- cotton to match (also black and white for eye embroidery);
- fine needle;
- stuffing (preferably flock or cotton wadding;
- Wire (about 18 in. of No. 10 fencing wire);
- ball point pen or sharp pencil, and a knitting needle.

Preparation

Enlarge the two main sections of the pattern to twice the size shown, then paste the pattern pieces on to the cardboard. When dry, cut out very carefully on the inside of the outline.

Using pen or pencil, outline the pattern pieces on the felt.

Instructions

1. Attach point E on head gusset to point E on kangaroo side body and glove stitch to end (that is, point F).

2. Attach the other side body piece to head gusset in the same way.

3. Embroider the eyes with black cotton using a touch of white cotton to give expression to the kangaroo.

The Author: *Mrs. Nina Martindale, Extension Officer* (*Women's Service*), *Farrer Place, Sydney.*

4. Fold the ears to point D and stitch to the marked outline on both sides of the head, points C to C and D to D.

5. At F join 2 side pieces together, glove stitching for above 1 in. to G, leaving space between points G and H open for stuffing. (This area is stitched last after the kangaroo has been stuffed.)

6. Continue glove stitching the 2 side body pieces from point H going around the tail to point J.

7. Using stuffing, start packing the tail very firmly. Use knitting needle as an aid.

8. Pin the pouch fold of the under body piece, A to A and B to B. Catch by stitching at these two points to hold firmly.

9. Glove stitch the kangaroo chin and neck from E to point K.

10. Attach under body piece to side body pieces at K. Glove stitch from K around the forepaw along the body to point X on tip of the foot.

11. Stitch the other side in the same way.

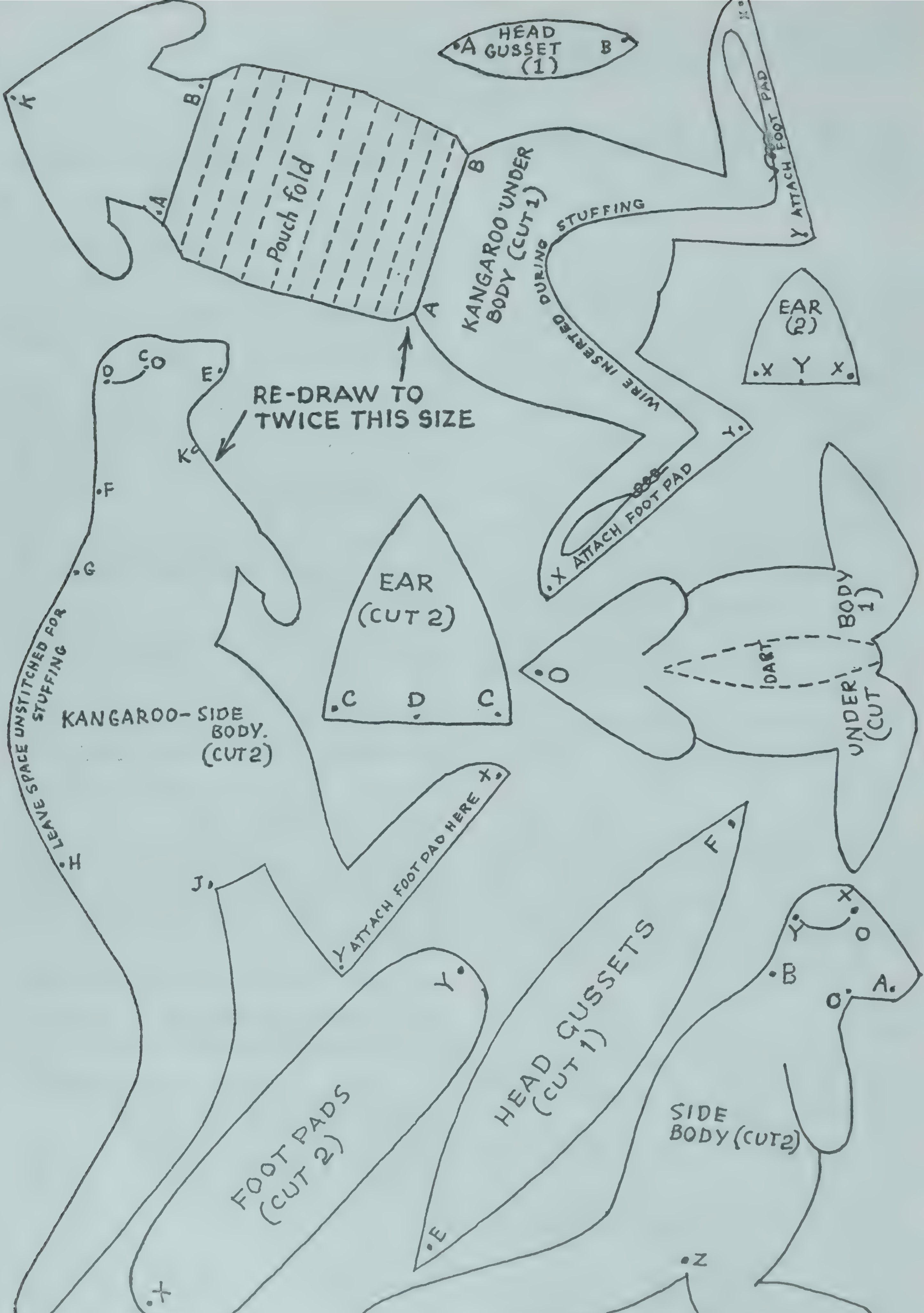
12. Attach foot pad to sides of body foot and under body foot starting at point X.

13. Attach the other foot pad to the other foot in the same way.

14. At point Y join the back leg seam commencing at Y. Continue glove stitching from one leg under the tail to the other leg until point Y on the other foot is reached.

15. Stuff head and forepaws firmly. Use knitting needle as an aid.

16. Stuff the two feet, packing well up into the toes.



The kangaroo and joey pattern. Re-draw the two parts indicated to twice the size shown

17. Make a loop on each end of wire (approx. size of paw) being sure the free end of the wire is firmly twisted and sharp end is protected, as illustrated on the pattern.

18. Bend the wire in the middle. Place two loops into the 2 feet, with wire bent up to reach the lower portion of the pouch.

19. Pack in firmly with stuffing and continue to stuff until the animal is very firm to the touch.

20. Lastly join the open back seam by glove stitching and press seam, over a damp cloth, with moderately hot iron.

Joey

1. Attach head gusset point A to A on joey's side body.

2. Repeat for the other side.

3. Embroider the eyes.

4. Fold the ears and attach to head, Y to Y and X to X.

5. Attach point O on the under body to point O on the side body. Continue to glove stitch around the forepaws, the side, around the feet to point Z under the tail.

6. Make a dart on the inside of the under body piece in the centre from point Z to where the forepaws meet.

7. Continue glove stitching on the other side of joey in the same way as the first.

8. Glove stitch around the tail from Z, leaving back open.

9. Stuff the tail. (It is necessary to fill the tail very loosely so it will fit into kangaroo pouch.)

10. Stuff the rest of joey very loosely except for the head and forepaws.

11. Finally glove stitch the back.

12. Place joey sideways in mother's pouch, then twist to make him sit up with forepaws over the pouch.

Note: To enlarge the two main body pieces to twice the size shown on page 124: Trace the parts on to a sheet of paper marked into half-inch squares. On another sheet of paper, draw a grid of one-inch squares. Simply copy the pattern, square by square, from the pattern on the small grid, to the squares of the large grid. Only these two parts need to be enlarged; all the other parts of the pattern are already the right size. •

TUBERCULOSIS-FREE HERDS

The following herds have been declared free of tuberculosis in accordance with the requirements of the scheme of certifying herds tubercle-free, and unless otherwise declared, this certification remains in force until the date shown in respect of each herd.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Australian Missionary College, Cooranbong (Jerseys)	123	Sept., 1965
Beddie, R. H., Old Grenfell Road, Forbes (Shorthorns)	124	Mar., 1965
Bonnington, R. A., "Leiroy", Shorthorn Stud, "Spring Camp", Curban (Beef Shorthorns)	77	Nov., 1965
Burke, J. & M. P., "Golden Valley", Forbes Road, Cowra (Beef Shorthorns)	62	Mar., 1965
Burnside Presbyterian Orphan Homes, North Parramatta (A.I.S.)	70	July, 1965
Cochrane, R. & C. C., "Parrabel Stud", Bega (Jerseys)	160	April, 1965
De La Salle College, Castle Hill (Ayrshires)	46	July, 1966
Eather, A. D. & J., "Milgarra", Bunnan (Beef Shorthorns)	65	Sept., 1965
Elsinora Pty. Ltd., Manna Stn., Forbes	485	June, 1965
Everingham, C., Taree Vale Jersey Stud, Taree	122	Jan., 1965
Ewin, N., "Edenview", Greghamstown, via Blayney (A.I.S.)	60	May, 1965
Fairbairn, C. P. & C., Woomargamma Stn., Hume (Beef Shorthorns)	549	Nov., 1966
Farrer Memorial High School, Nemingha (A.I.S.)	93	May, 1964
Fleming, T. H. & Sons, "Russley", Aberdeen (Polled Shorthorns)	337	Aug., 1965
Franciscan Missionaries of Mary, Range Road, Mittagong (Friesians)	83	Mar., 1965
Freudenstein, F. J. & G. F., "Chippendale", Grenfell Road, Young (Beef Shorthorns)	89	June, 1966
Freudenstein, W. J. A. & Son, "Chippendale", Grenfell Road, Young (Beef Shorthorns)	133	June, 1966
Glen Mitchell Pastoral Co., Wellington (Poll Shorthorns)	170	April, 1966
Grafton Experiment Farm, Grafton (A.I.S., Angus)	397	Aug., 1964
Greaves, J. A., "Baroona", R.M.B. 63, West Wyalong (Beef Shorthorns)	44	Nov., 1965
Grey, T. J., Estate, "The Meadows", Albion Park (Jerseys)	147	Sept., 1966
Hawkesbury Agricultural College, Richmond	247	June, 1965
Hill, R. H. and Sons, Bulliac (A.I.S., Jerseys)	71	Oct., 1964
Hurlstone Agricultural High School, Glenfield (Ayrshires)	67	Aug., 1965
Limond Bros., Morisset (Ayrshires)	99	Aug., 1965
McSweeney, W. J., "The Rivers", Canowindra (Polled Shorthorns)	83	May, 1965
Maloney, D., "Heathvale", Broadwater (Jerseys)	46	Sept., 1966
Markham, J. & E., "Mara", Branxton (Jerseys)	57	Aug., 1965
Mullee Stud Farms Pty. Ltd., "Nairobi", Scone (Poll Herefords)	123	May, 1966
Mutton, J. T. & Sons., Bolwarra, Maitland (Jerseys)	100	Feb., 1965
O'Dea, C., "Sunnyside", Nepean Stud, Nth. Richmond (Friesians)	109	Mar., 1966
Peel River Land and Mineral Co., "Goonoo Goonoo", Tamworth (Polled Shorthorns)	230	Oct., 1964
Pratt, H. F., "Field View", Reserve Creek via Murwillumbah	127	Nov., 1966
Reid, D. B., "Evendale", Sutton Forest (Angus)	130	Dec., 1964
Reid, G. T., "Narrengullen", Yass (Angus)	540	June, 1965
St. Vincent's Boys' Home, Westmead (A.I.S.)	16	June, 1965
Scobie, C. & Son, Abingdon Jersey Stud, Lorn, Maitland	143	Sept., 1964
Simpson, F. S., "Gunnawarra", Gulargambone (Beef Shorthorns)	238	Aug., 1965

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds—*continued*		
Simson, J. N., "Nowley", Spring Ridge (Shorthorns)	227	Feb., 1966
The Scots School, Bathurst (Friesians)	31	Nov., 1965
Training Farm for Boys, Berry (A.I.S.)	153	Jan., 1965
Trangie Agricultural Research Station, Trangie (Angus)	175	May, 1966
Vitnell, A., Dalwood (A.I.S.)	115	Feb., 1965
Wagga Wagga Agricultural College (Jerseys, Poll Shorthorn)	167	May 1965
Walsh, Mrs. H. R., "Water View", Cowra (Beef Shorthorns)	120	Mar., 1965
Waters, G., "Willow Dell" Jersey Stud, "Boongala", Deniliquin	139	Mar., 1965
White, H. F., Bald Blair, Guyra (A.A.)	147	June, 1965
Willis, R. N. & D. M., Westbrook, Mt. Hunter, via Camden (Ayrshire)	168	Nov., 1964
Wollongbar Agricultural Research Station, Wollongbar (Guernseys, A.A.)	145	June, 1964
Wombramurra Pty. Ltd., "Wombramurra", Nundle (Devon)	136	April, 1966
Wright, Miss I. M., "Awatea Jersey Stud", Paddy's Plains, North Dorrigo	56	Dec., 1964
Yanco Agricultural High School, Yanco (Jerseys)	119	Oct., 1964
Yanco Agricultural Research Station (Jerseys, Guernseys)	127	Dec., 1965
Herds Other than Registered Stud Herds		
Adams, B. & L., "Garryowen", Wallamore	67	Nov., 1964
Adastra Dairies Pty. Ltd., Terrace Rd., North Richmond	106	July, 1966
Baker, R. W., Luskintyre, Lochinvar	74	Oct., 1966
Barnardo's Homes, Dr., Tooloogan Vale, Scone	157	Feb., 1965
Bennett, J. F. M., "Oaklands", Pambula	90	May, 1965
Bethsam Holiness Mission, Wyee	23	Feb., 1965
Bladwell, W. R., "Loloma", Goulburn	128	Dec., 1965
Bowen, A. H., Stroud	73	April, 1966
Bridge & Bowden, Mill Creek, Stroud Road	47	April, 1965
Brookfield Afforestation Camp, Mannus	268	May, 1965
Brown, R., Valery	58	Aug., 1965
Camden Park Estate, Menangle	2715	Nov., 1964
Charlton, R. J., Caniba Street, Lismore	66	Dec., 1965
Chesham, C. H., Picton Road, The Oaks	45	April, 1965
Child Welfare Dept., "Werrington Park", St. Marys (A.I.S.)	34	Feb., 1965
Coilsfield Pty. Ltd., "Coilsfield", Orange	244	Dec., 1965
Cole, E. J. & Sons, Lochiel	127	April, 1966
Cole, G., South Pambula	53	Oct., 1964
C. V. and H. G. Denton, "Yarrawood Farm", Merimbula	91	May, 1965
Croagh Patrick Orphanage, Park St., Orange	61	Feb., 1966
Duck Creek Farm, Wollongbar	118	June, 1964
Dunshire, J. S., "Glenara", Riverview Rd., Lansvale	164	May, 1965
Ellensville Est., "Ellensville", Glenmore, via Camden	153	Dec., 1964
Ellwood, H., Attwater Avenue, Cessnock	61	Mar., 1966
Enright, M. (Mrs.), "Hinton Vale", Hinton	95	June, 1966
Fairbridge Farm School, Molong	56	Jan., 1965
Farley, D. J., Stroud	88	Dec., 1965
Foley, L. F., Lucknow, via Orange	29	Dec., 1965
Forster & Sons, "Abington", Bundarra	53	April, 1966
Franciscan Fathers, Maryfields, Campbelltown	50	April, 1966
Gilbert, A. E., Mill Creek, Stroud	117	Aug., 1966
Gorton, I. E., Stroud Road, N.S.W.	76	Dec., 1966
Greenham, J. R., Hill Creek, Stroud	45	Sept., 1965
Harrington, J. B. & J., "Mt. Erin", Campbelltown	97	Nov., 1965

Tuberculosis-free Herds—continued

Owner and Address	Number Tested	Expiry Date
Herds other than Registered Stud Herds—*continued*		
Harrington, P. P., "Glen Erin", Leumeah	69	Nov., 1965
Hawkey, H. R., "Trevone", Menangle	271	Nov., 1964
Hawkins, G. A., Freemans Reach	63	Mar., 1965
Her Majesty's Training Centre, Emu Plains	164	Feb., 1965
Her Majesty's Training Centre, Goulburn	31	Mar., 1965
Hill, W. S., "Questwill", Crooked Lane, North Richmond	55	July, 1966
Hill, R. H. & Sons, Bulliac	107	Oct., 1966
Johnson, J. R. & P. M., Wallamore Road, Tamworth	123	July, 1965
Kenmore Hospital, Kenmore	120	Mar., 1965
Lee, G. N., Taree	62	Nov., 1966
MacArthur Stanham Holdings Pty. Ltd., Camden Park, Menangle	276	Oct., 1965
McGrogan, J., Percy Street, Singleton	80	Jan., 1965
Margery, G. W., Stroud Road, Stroud	68	Aug., 1965
Merchant, Mrs. P., East Gresford	85	Dec., 1965
Moffit, C. E., Central Tilba	149	Jan., 1964
Monkittee Pastoral Co., Braidwood	47	Nov., 1965
Morisset Hospital, Morisset	84	Mar., 1965
Moxham Bros., "Mullengudgery", Mullengudgery	106	Dec., 1964
Mt. Penang Training School (Gosford Farm Homes), Gosford	68	May, 1965
Naroo Pastoral Co. Pty. Ltd., "Jemalong", Forbes	403	Jan., 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong	101	Sept., 1965
O'Dea, C., "Sunnyside", North Richmond	94	Mar., 1963
Odewahn, R., 113 Argyle St., Parramatta	20	Sept., 1965
North Parramatta Psychiatric Centre	48	Aug., 1965
Passionist Fathers, Mary's Mount, Goulburn	16	Mar., 1965
Perry, K. T., Millingandi, via Eden	69	July, 1965
Pitt, S. R., Wylie's Flat, via Singleton	44	July, 1966
Ramsey, E. J., "Manor Park", Parkes	100	Feb., 1964
Ryan, P., Hallsville	33	July, 1965

Owner and Address	Number Tested	Expiry Date
Herds Other than Registered Stud Herds—*continued*		
Rydalmere Hospital, Rydalmere	28	Nov., 1965
Scott, S., Mullumbimby	71	Sept., 1966
Shelldrake Bros., "Clearview", Box 11, Picton	93	Nov., 1966
Simpson, A. T., "Kenso", Forest Road, Orange	191	April, 1966
Stinson, J. B., Church Lane, Castlereagh	88	Oct., 1966
St. John of God Training Centre, Morisset	22	Sept., 1965
St. John's Orphanage, Goulburn	9	Mar., 1965
St. Joseph's Orphanage, Cowper	70	Nov., 1964
St. Joseph's Orphanage, "Kenmore", Goulburn	5	Mar., 1965
St. Joseph's Orphanage, Kincumber	39	April, 1966
Sternbeck, C. H., Laguna House, Laguna	109	April, 1965
Sydney Church of England Grammar School, Moss Vale (Jerseys)	161	Dec., 1964
Tegel, A. A. Pty. Ltd., Heath Road, Leppington	92	Nov., 1966
Thompson, L. K., "Redbourneberry", Singleton	85	Mar., 1966
Turner, R. G., "Merriwinga", Tilba Tilba	67	Sept., 1964
Training School for Boys, Mittagong	104	Feb., 1964
United Protestant Association, "Sunny Lands", Wollongbar	41	Jan., 1965
Whelan, W. G., Kiah, via Eden	62	Nov., 1966
Whelan, W. R., Bulahdelah	56	April, 1966
Wiley, F. J., Candelo	12	June, 1965
William Thompson Masonic School, Baulkham Hills	66	Sept., 1965
Williamson, R. J., Fattorini Island, Gladestone, N.S.W.	55	April, 1966
Wilson, A. J., Nicholls Street, Stroud	57	Nov., 1965
Wilson, K., Woodlawn, via Lismore	51	Sept., 1966
Wood, Mrs. J., Redbourneberry, Singleton	16	Sept., 1966
Youth Welfare Association of Australia, Hopegood, Bowral	241	Dec., 1966

R. M. WATTS, Chief, Division of Animal Industry.

Brucellosis-free Herds (Cattle)

The following herds have been declared free of brucellosis in accordance with the requirements of the scheme of certifying herds brucellosis-free.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Burke, J. and M. P., "Golden Valley", Cowra (Beef Shorthorn)	58	April, 1965
De La Salle College, Oakhill, Castle Hill (Ayrshire)	46	July, 1965
Hurlstone Agricultural High School, Glenfield (Ayrshire)	67	Aug., 1965
McSweeney, W. J., "The Rivers", Canowindra (Poll Shorthorns)	83	May, 1965
"Wombramurra", Pty. Ltd., Nundle (Devon)	135	May 1965

Owner and Address	Number Tested	Expiry Date
Herds Other than Registered Stud Herds		
Fairbridge Farm School, Molong	56	Feb., 1965
Forster & Sons, "Abington", Bundarra	53	Mar., 1965
Mt. Penang Training School, Gosford	62	June, 1965
St. John of God Training Centre, Morisset	21	Feb., 1965
Training School for Boys, Mittagong	98	Feb., 1965

R. M. WATTS, Chief, Division of Animal Industry.

Brucellosis-free Herds (Swine)

The following is a list of names and addresses of owners of herds which have been declared brucellosis-free in accordance with the requirements of the Brucellosis-free Herd Scheme (Swine).

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Boyle, W. R., Alford Point Road, Menai (Tamworth and Berkshire)	15	June, 1965
Campbell, D. C., " Hillangrove Stud ", Wamberal (Large White)	14	Feb., 1965
Carter, P. L., Woorak Stud, Pine Ridge, via Quirindi (Tamworth & Large White)	37	July, 1965
Draper, R. E., " Glengar ", Capertee (Tamworth)	6	Nov., 1965
Farrer Memorial Agricultural High School, Nemingha (Berkshire)	9	April, 1965
Grafton Experiment Farm, Grafton (Berkshire)	15	April, 1965
Hawkesbury Agricultural College, Richmond	55	Mar., 1965
Hurlstone Agricultural High School, Glenfield (Berkshire)	7	Sept., 1965
Registered Stud Herds—*continued*		
Lambeth, A. J., " Talanga ", Douglas Park (Berkshire)	11	May, 1965
Maxwell, J. D., " Brooklyn ", Barmedman	10	July, 1965
Mt. Penang Training School, Gosford (Berkshire)	10	June, 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong (Berkshire)	7	Aug., 1965
Wagga Agricultural College (Berkshire, Tamworth and Large White)	22	Sept., 1965
Wollongbar Agricultural Research Station, Wollongbar (Tamworth)	29	July, 1965
Yanco Agricultural High School, Yanco (Berkshire)	19	Sept., 1965
Herds Other than Registered Stud Herds		
Brookfield Afforestation Camp, Mannus	14	April, 1965

R. M. WATTS, Chief, Division of Animal Industry.

Areas Undergoing Regular Testing for Tuberculosis

Quarantine Areas (Tuberculosis)—Urban Areas

The following areas have been declared quarantine areas to ensure that a tubercle-free milk supply is available to residents. No cattle from which milk or milk products are obtained for human consumption are allowed to be kept therein unless subjected to the tuberculin test and found free from tuberculosis:

Barraba
Bingara
Braidwood
Casino
Condobolin
Coonabarabran
Coonamble
Crookwell
Glen Innes
Grenfell
Griffith
Inverell
Junee
Kempsey
Moree
Muswellbrook
Parkes
Queanbeyan
Walgett

Quarantine Areas (Tuberculosis)—Eradication Areas

The following areas have been declared quarantine areas for the purpose of eradicating tuberculosis from cattle contained therein. All owners are required to have all their cattle tested for tuberculosis when notice for testing is served:

Bellingen
Bodalla
Brushy Hill
Burringbar
Caniaba
Cessnock
Chichester
Clybucca
Comboyne
Coraki
Cumberland
Denman
Dorrigo
Dungog
Dyraaba
East Casino
East Kempsey
Fawcetts
Illawarra
Kyogle
Lavadia
Lawrence
Lower Hunter
Maitland
Manning
Milton
Moss Vale
Mullumbimby
Myrtle
Nimbin
Nth. Tweed
Salisbury
Singleton
Southgate
South Lismore
Stewart's River
Tintenbar
Tyalgum
Ulmarra
Upper Richmond
Upper Wollomba
Warkworth
West Kempsey
Wingham
Woodburn
Woodford Island

Tuberculosis Protected Area

The following areas have been declared tubercle free and no cattle are allowed to be kept therein unless subjected to the tuberculin test and found free from tuberculosis.

Bombala
Bredbo
Broken Hill
Cooma
Gulgong
Warialda

R. M. WATTS, Chief, Division of Animal Industry.

V. C. N. BLIGHT, GOVERNMENT PRINTER

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Improved Pastures Don't Pay Without More Stock

R. D. EASTOE

A FAT SHEEP appeals to a stockman's eye as a polished car does to the eye of a chauffeur. The "finish" on either, however, adds little to efficiency.

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Mid-winter at Shannon Vale in the northern tablelands. Ewes running at two per acre on phalaris have left a lot of feed unused. This country, in its natural state, cannot support breeders, and once carried only ¾ dry sheep per acre.

Also at Shannon Vale in the period of lowest pasture production. Ewes at six per acre, and still with more than enough feed to see them into spring.

Sheep that are always in good condition are an indication that the property is understocked. The property owner has put a lot of thought, energy and money into his pasture improvement programme, but has not used the pasture profitably. Much of the good work of establishment can be undone by low stocking, because the palatable species are selectively grazed and the coarser, introduced or natural species become dominant.

New South Wales as a whole is understocked. Taking the number of sheep and the total area of rural holdings, the average stocking rate for the State is only four tenths of a sheep per acre. If the low rainfall Western Division and the coastal belt, unsuited to sheep, are left out of calculations, the remaining "safer" area is stocked at less than three quarters of a sheep per acre. If allowance is also made for cattle as equal to eight sheep per head, the stocking rate of the safer area still works out at less than one sheep per acre.

There are many reasons why sheep raisers do not make full use of improved pastures. The two main ones are the fear of drought and hesitancy to accept the additional care in management.

The fear of drought has created a cautious approach to stocking. As well as fear of drought there is a reluctance to stock so heavily that sheep may lose condition. The reluctance is justified in the case of ewes in the stress of pregnancy or lactation, but a pasture that is not good enough for pregnant or lactating ewes will often carry dry sheep for quite a long period.

Private farms and government research stations have shown that very high stocking rates are possible. More than ten sheep per acre have been carried on relatively poor country, with a reasonable rainfall. In some cases it was the poorness of the country that originally forced owners to act. They had to improve pastures and raise stocking rates to get an economic return. Well-managed pastures and high stocking rates have made

farms productive and profitable on mediocre country.

The approach to increased stocking will vary from district to district. Strategic grazing was considered important in securing a very high wool production per acre at the Department's Shannon Vale Nutrition Station. Despite this, results have been excellent with set stocking of wethers at C.S.I.R.O. field stations, and more recently at Shannon Vale as well.

At Wagga, where the normal stocking rate is not much more than one sheep per acre, two, four and six sheep per acre were tried. They were set stocked on subterranean clover-based pastures. There were distinct problems with six sheep, but four sheep were carried quite successfully.

Lifting stocking rates has not been confined to research stations. Some private properties have had similar successes, and have dramatically increased the number of stock carried.

When a grazier has lifted stocking rates to the limit of improved pasture production, cropping may allow a further increase. In the central west the University of Sydney has been testing the value of heavy seeded oats with nitrogen to produce large quantities of feed in the winter, when the production of improved pastures is low. They have found that oats with nitrogen can yield 3,000 lb. per acre, whereas a rye-clover pasture only produced 530 lb. in the same period.

It would not be wise to try to achieve very high stocking rates on a property in one move. The increase should be steady enough to work out the methods needed for the particular district and the individual farm. A reasonable aim in most districts of New South Wales, where improved pastures are grown, would be to double the district stocking rate as soon as possible. It is only then that special managemental techniques needed for a further increase should be considered. ●

NEW DEVICE TO HELP PRODUCE BETTER BUTTER

Fig. 1. The Moisture Dispersal instrument showing conductivity probe and meter

C. W. Lattimore and A. L. Short

IT IS COMMON KNOWLEDGE in the butter industry that to make a butter which will have good keeping quality, one must fully incorporate the water into the butter by proper and complete working. Research workers have also amply demonstrated this. L. L. Muller, working in Queensland, published results in 1952 showing the relationship between the microscope count of moisture droplets and the loss of graders' points after storage. The butters which lost fewest points contained the smallest number of larger droplets. Other workers have also shown that bacterial growth is limited by a fine dispersion of the moisture. Zheltakov (1949) in Russia, and Mohr, Mohr and Drachenfels (1959) in Germany, made contributions in such work.

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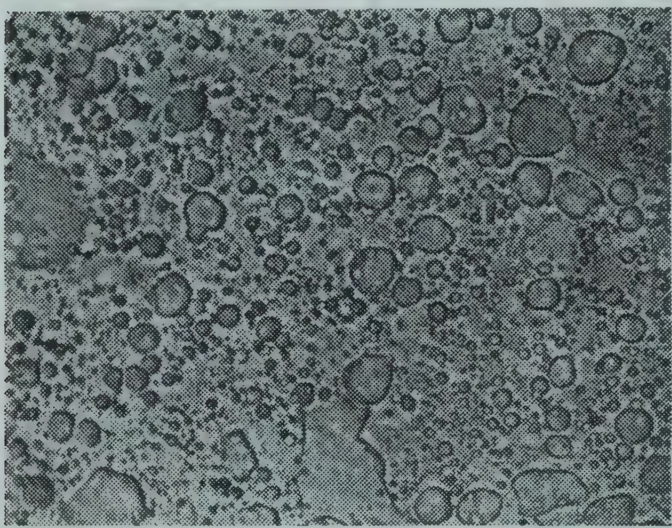
Water added to a churn initially splashes about, but in a very few minutes of working in the churn, only some smears of water on the butter surfaces can be distinguished. The water is then completely taken up by the butter and can no longer be seen by the unaided eye. The butter requires to be worked further from this stage because the droplets are relatively large and must be reduced even further in size. Photo micrographs of butters are shown in fig. 2. The large drops in (a) are from a butter sample worked for two minutes. The droplets are further reduced, as shown in (b), after two more minutes, and then finally to the best condition, shown in (c), after a total working time of eight minutes.

The butter maker depends on his experience to determine the full working time necessary to attain the most desirable dispersal of the moisture. Sometimes this full working cannot be given because of a sticky condition developing in the butter. This mostly occurs during spring, when soft fats are present in cow's milk fat. Other factors may also prevail upon the butter maker, forcing him to reduce the working period. The grader can detect butters which have not been properly worked by the free water that is observed on the sampling trier.

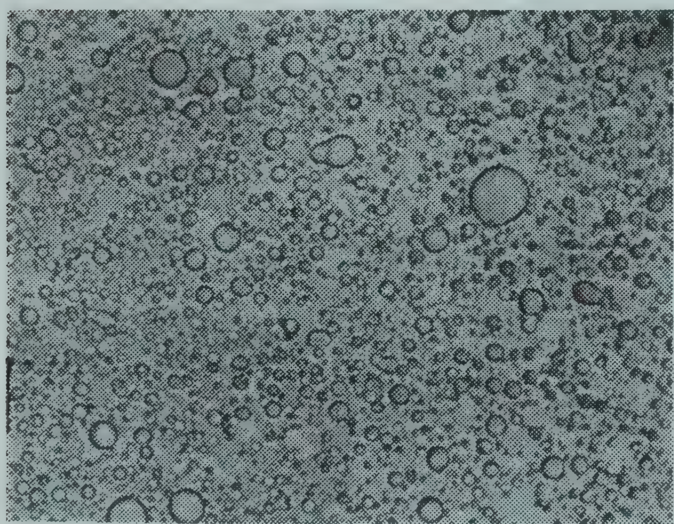
The size of the water droplets is measured as their diameter in microns. One micron is a millionth of a metre, or 1/25th of a thousandth of an inch. For comparison, the gap of a motor car sparking plug is 15 to 20 thousandths of an inch. The most desirable size of water droplets in butter is less than 10 microns; this means that it would take 500 of them to span a sparking plug gap. When the water disappears from sight during working, water droplets are about 200 microns.

Reducing the size to 10 microns requires experience to know when this stage has been reached. An inexperienced butter maker may well leave the droplets ranging between 20 and 50 microns in size. Measuring the sizes would be the only way to know the extent of the dispersal of the water, but the methods that have been used are not practicable in the butter room.

The measuring is usually done with a microscope, but this is time consuming and needs the facilities of the laboratory. The



(a)



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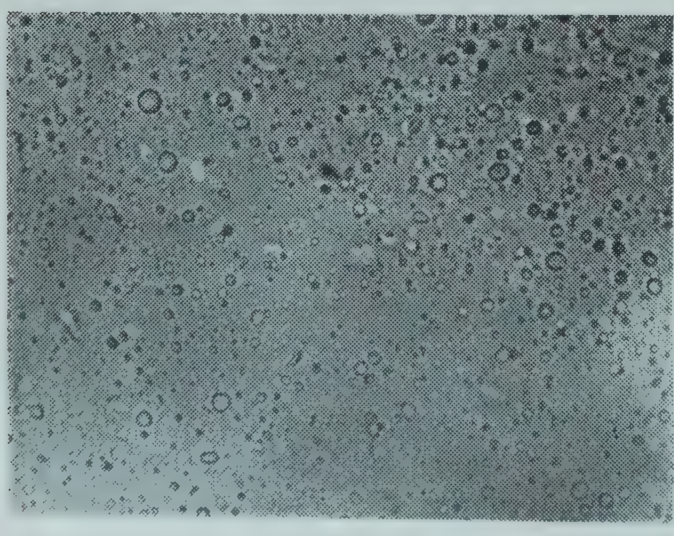

(c)

Fig. 2. The moisture droplets in butter at different stages of working are illustrated above: (a), early; (b), middle stage; (c), final stage.

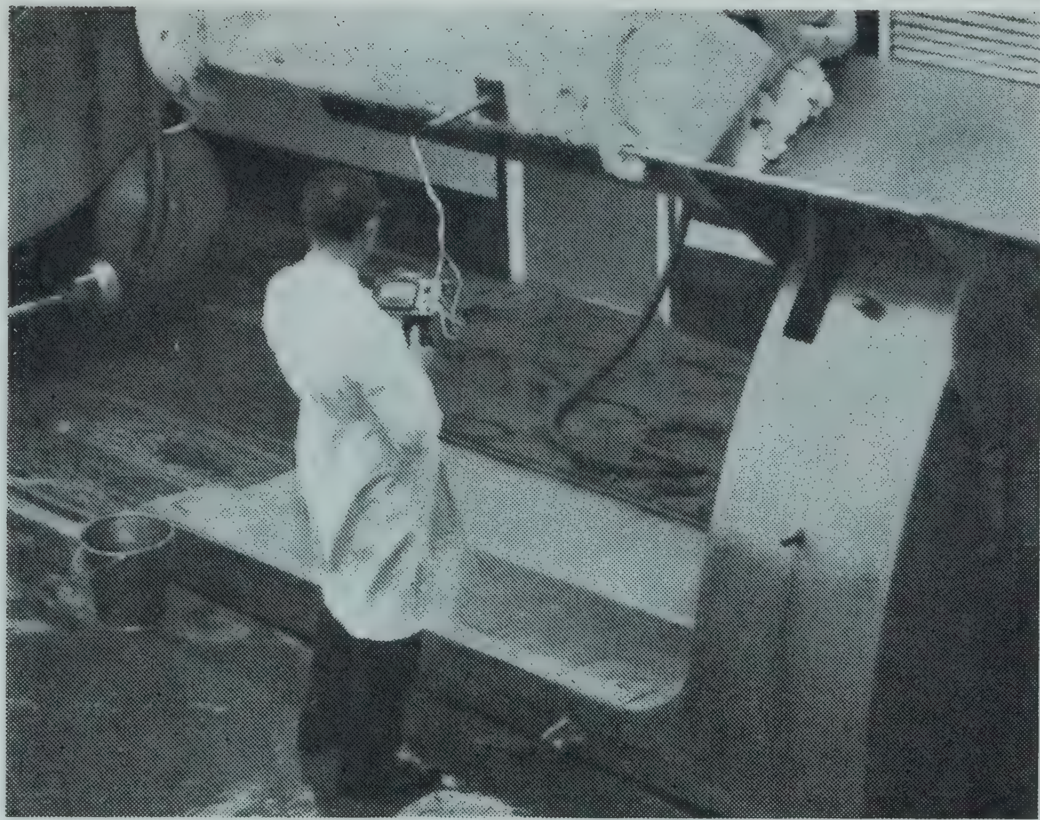

Fig. 3. Use of the instrument on butter from the churn

Queensland Butter Board does use the microscope method and has developed a routine from previous work of L. L. Muller (1952) which enables samples to be measured in a reasonable time. A new instrument has been developed recently by A. L. Short in collaboration with H. P. Mulligan. This instrument enables the reading of moisture dispersal to be made in the churn room or of butter in the box, and the measurement is completed in a few seconds.

This method has been developed from a principle put forward by Prentice (1953), who showed, when investigating the electrical conductivity of butter that a decrease in droplet sizes caused a decrease in the conductivity. Special electrical apparatus was necessary to measure the very small conductivity, because even the most conductive butter is still highly resistant to the passage of an electric current. The equipment used by Prentice was not ideally suitable for use in the factory. The new apparatus developed consists essentially of a conductivity container for the butter sample and a device that supplies the current and reads it in thousandths of an amp. The development of the conductivity cell or container was continued through several modifications. The latest development (fig. 1) is simple and quick to use, and does not necessitate the removal of a sample of butter from the original batch. The cell is in probe form and is shown partially immersed in a block of butter. Behind the probe is the electrical apparatus showing the meter face. The easily carried box contains the electrical circuit and a 7½-volt battery which supplies power.

The conductivity probe design has been submitted for patent. It consists of three stainless steel vanes, wedge-shaped and mounted in an epoxy resin base. A polyvinyl chloride handle is attached for easy manipulation of the probe and from the handle passes the electrical lead. The circuit required considerable development, and finally a transistorised oscillating series circuit was made up. A checking resistor has been built into the apparatus so that the meter can be adjusted in the "Set" position. When the meter is switched to the "Read" position and the probe is immersed in the butter sample, the meter pointer will indicate the moisture dispersal directly as a current value. High values will be obtained from poorly dispersed moisture and low values from the properly worked butters. Examples of the use of the instrument are shown in figs. 3 and 4.

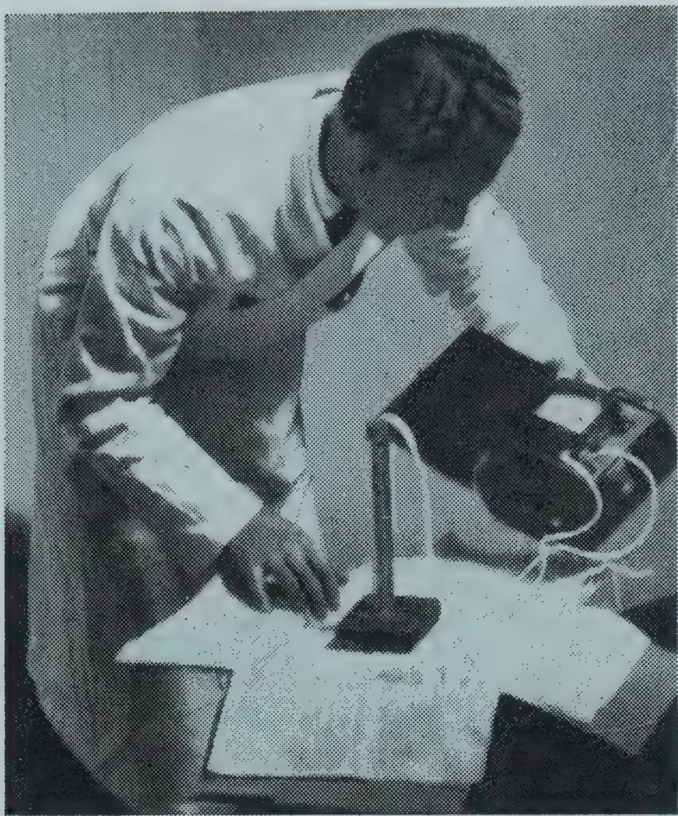

Fig. 4. The use of the instrument on butter contained in a 56 lb. box

In fig. 3 the probe has been pushed into a batch of butter on the barrow soon after removal from the churn. In fig. 4 a box of butter is being tested before being put into the cold store.

Two of the instruments are already on trial. One, at Hunter Valley Co-operative Dairy Co. Ltd., is being used in a storage trial, and the other is being tested by the Department in research projects. It is expected that the results of these projects will be published in the near future and the influence of the instruments on butter manufacture will be analysed.

It is possible that this instrument will be a useful tool in the butter industry. It is designed to help the butter maker to obtain a more complete picture of the texture of his product, particularly if the churning operation has shown any abnormalities.

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Thanks are due to Mr. H. P. Mulligan, of H. P. Mulligan Pty. Ltd., for his interest and assistance in the development of the electrical equipment described above. ●

Cut Machinery Repair Bills

Farmers are advised to closely examine their machinery repair methods to help cut costs.

Excessive charges can be avoided by getting a quotation for the work after the machine has been pulled down and inspected.

If a firm quotation cannot be obtained, a ceiling price should be fixed.

In this way a farmer knows his commitments on the job before work begins.

Only resort to "cost plus" work in emergencies.

Maintain equipment according to recommendations made in makers' instruction manuals.

This will greatly reduce the need for costly overhauls and repairs.

Overhaul costs can also be reduced by having repairs done early in the off-season.

Off-season repairs give plenty of time to order and receive replacement parts.

This avoids costly air freight and passenger train freight charges, usually passed on to the farmer.

Timely overhauls reduce or eliminate expensive overtime work to get machinery into good working order in a hurry. ●

Prevention is better than cure, but just in case—

FIRST AID FOR POISONED LIVESTOCK

G. E. Charles

From time to time owners lose stock through poisoning by one of the many toxic substances in common use. Such cases often occur despite precautions. However many are due to lack of care. Most poisonings arise from stock having access to toxic plants, discarded poisons and their containers, toxic baits and treated plant material or from inadequate precautions associated with the application of insecticides.

This article details some of the more common poisons, their effects on stock, and first aid treatment.

First aid treatment should be commenced immediately. In all cases owners should contact without delay a veterinarian, who will have drugs not readily available to stockowners.

Arsenic

Arsenic is probably the most common poison found on farms and is usually in the form of sheep dips or weed killers. It has an attraction for livestock, who eat it readily or lick ground contaminated by it. Arsenic is virtually indestructible, and con-

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taminated soils can remain dangerous for many years. Poisoning also can occur as a result of absorption through the unbroken skin. This is seen when freshly dipped sheep have been exposed to rain before drying has taken place.

Whatever the method of contact, the principal effects of arsenic poisoning are observed in the stomach and intestines. In acute cases, there is marked abdominal pain and profuse scouring; the droppings often containing blood and shreds of bowel lining. Thirst is increased greatly. Death may occur within 12 hours. In subacute cases the symptoms are similar but the onset and development are slower.

Post mortem examination shows the lining of the stomach and intestines to be very red and inflamed and the contents of these organs are fluid and tinged with blood. The liver may be enlarged.

Treatment

Treatment is usually only successful if undertaken early. BAL (British anti-Lewisite) is the drug of choice but sodium thiosulphate (i.e., photographic hypo) is useful in early cases and may be given by mouth or by intravenous injection.* Dose rates are as follows:

BAL. 2 to 3 mg. per lb. body weight intramuscularly. Repeat at 8 to 12 hourly intervals if necessary.

Sodium thiosulphate (*hypo*). 0.1 c.c. per lb. body weight intravenously of a 10 per cent solution (i.e., 2 oz. sodium thiosulphate dissolved in 1 pint of water).

Where intravenous injections cannot be made, some benefit may accrue from giving the sodium thiosulphate as a drench. Adult cattle should receive 2 oz. and adult sheep ½ oz., in each case dissolved in a convenient quantity of water. For young stock the quantities should be reduced proportionately to their size.

Up to 2 pt. of paraffin oil, milk or limewater may be given as a drench and repeated after two hours. The whites of 6 to 12 eggs may also be given. These recommendations are for cattle but other stock may receive quantities proportionate to their body weight. Limewater is prepared by adding a handful of slaked lime to a quart of rain water, shaking vigorously, allowing to settle and pouring off the clear fluid, which is then used for the treatment. However, once the poisoning is well established, treatment by mouth is of little value.

Strychnine

Strychnine is at times used to kill foxes and rabbits. Among the domestic animals poisoning with this material is most common in dogs.

The first noticeable symptom is increased respiration, the animal becoming uneasy and possibly yawning frequently. Muscular twitchings occur and these are followed by convulsions in which the legs are rigidly extended, the head thrown back, and the back hollowed. The eyes are open, pupils expanded and the corners of the mouth drawn back. The convulsions occur at regular intervals and may be brought on by any external stimulus such as a current of air or slight noise.

Treatment

The following treatments may be used for dogs:

(*a*) Tincture of iodine, 1 c.c.
Water, 15 c.c.
To be given by mouth.

or

(*b*) Condy's crystals, ¼ oz.
Water, 1 pint.
Give dogs up to 4 fl. oz. as a drench.

or

(*c*) Up to 1 pint of cold, very strong black tea may be given by mouth.

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* There are three main types of injections:

Intravenous—directly into a vein, usually the jugular vein. This is best given by a veterinarian.

Intramuscular—into a muscle. The most suitable site is the rump or thigh. Insert the needle at right angles to the skin, and make it penetrate from one to two inches.

Subcutaneous—immediately under the skin. Pinch up a fold of skin with the thumb and fingers. Insert the needle into the underlying space so formed between the skin and the muscle.

In the very early stages the dog may be induced to vomit in an endeavour to eliminate any of the poison remaining in the stomach. For this purpose a sheep dog may be given 3 teaspoons of salt with half a teaspoon of mustard in 4 fl. oz. of water. For other dogs the quantities should be varied in accordance with the size of the animal.

This treatment is inadvisable however once convulsions are established, otherwise the animal may suffocate while vomiting. The patient should be left quietly in a darkened room and if possible veterinary assistance obtained.

Phosphorus

Phosphorus is mainly employed for the control of crows and foxes.

The onset of symptoms is sudden but the course of the poisoning is often prolonged over three or four days. In the early stages there is vomiting, marked pain, severe diarrhoea which may contain blood, and a peculiar garlic-like odour of the breath. On the third or fourth day haemorrhage and severe jaundice occur as the result of liver damage. The affected animal soon becomes prostrate and dies in convulsions.

Post-mortem examination reveals severe gastroenteritis, fatty liver, many haemorrhages and the blood is black and tarry and fails to clot.

Treatment

Treatment must be commenced early. Dissolve $\frac{1}{4}$ oz. of Condy's crystals in 1 pt. of water. Drench horses and cattle with the full amount, sheep and pigs with half the quantity, and give dogs 4 fl. oz. of the mixture. This should be followed by a purgative of Epsom salts at the following dose rates :

Cattle—1 lb. in 2 pt. of water.

Horses—3 to 4 oz. in 2 pt. of water.

Sheep and pigs—3 oz. in 1 pt. of water.

Dogs—$\frac{1}{4}$ oz. in 4 fl. oz. of water.

It is important that affected animals do not receive oil as this may dissolve the phosphorus, leading to increased absorption.

Lead

Lead is a cumulative poison and repeated small doses can result in death. Common sources of lead are old batteries, red lead, discarded paint tins, old flaking paintwork, the use of lead-lined drums, and orchard sprays such as lead arsenate. The manufacture of lead-free paints in recent years has done much to reduce the lead poisoning hazard.

In acute lead poisoning, particularly in young animals, death may occur after symptoms of mania lasting only 20 minutes. In less severe cases affected stock are dull, walk in circles, appear blind, and grind the teeth. Muscular twitchings develop, especially of the eyelids, followed by convulsions. In pigs and dogs, vomiting and paralysis of the muscles of the jaw occur. In chronic lead poisoning, loss of appetite, depression, constipation, muscular weakness and inability to rise are common symptoms.

On post-mortem examination acute cases show severe inflammation and numerous small haemorrhages in the stomach and intestine. In chronic cases the liver is yellow and mottled.

Treatment

Treatment depends on the extent of the tissue damage. In early cases subcutaneous injections of calcium versenate are of value. Dissolve 16 grammes of calcium versenate in 100 c.c. of water and inject subcutaneously at the rate of 20 c.c. of the solution per 100 lb. live weight. Epsom salts in repeated small doses are helpful. Give cattle 2 to 3 oz. of Epsom salts twice daily for several days. The dose for sheep is $\frac{1}{2}$ to 1 oz. However, in sheep and cattle, pieces of lead may be present in the second stomach and no treatment will be of value until they are removed surgically.

Mercury

Orchard sprays are the common source of mercury, and some bunticides contain mercury compounds; dusted wheat can be dangerous, too.

In acute cases the onset of symptoms is sudden. Vomiting can occur in pigs and dogs. A haemorrhagic diarrhoea follows, and death may occur suddenly. In chronic cases the onset is slow, the animal is dull, loses appetite and weight and develops scours. Paralysis of the hindquarters, blindness and anaemia develop.

Post-mortem examination in acute cases reveals ulcers in the stomach, and strips of intestinal lining may be separated. Haemorrhages are present in lungs, kidney and liver, and the blood is dark and clots slowly. In chronic cases the liver shows small, pale, depressed areas (necrosis). Organs are pale due to anaemia, and the heart is enlarged and flabby.

Treatment

Treatment consists of giving the whites of up to 12 eggs, or 1 to 2 pt. of a gruel of flour and milk, followed by a purgative such as Epsom salts at the dose rates shown under the heading "Phosphorus".

Organo-phosphate insecticides

An organic phosphate is the active principle of many modern insecticides and some drenches. These include preparations such as malathion, Ronnel®, Asuntol®, diazinon, Neguvon®, Dipterex®, montrel, Delnav®, Bercotox®, Rogor® and Nankor®.

The most marked symptoms are profuse salivation, laboured breathing, abdominal pain, staggering and convulsions. The onset of symptoms may be very rapid, becoming obvious within 5 or 6 minutes after exposure, or may be delayed for several hours. The course is generally rapid, death occurring or the critical stage being passed within a matter of hours.

Post-mortem examination usually shows nothing of any significance.

Treatment

A suitable antidote is as follows:

Atropine sulphate 1/3rd grain.

Distilled water 3½ fl. oz.

® Registered trade name.

Dose: (cattle) subcutaneous injection of 1 c.c. per 10 lb. body weight; (sheep) subcutaneous injection of 1 c.c. per 10 lb. body weight.

If the affected animal had been treated externally with an organic phosphate, it should be washed down and then kept in a quiet place.

A very important matter to be borne in mind is the potential toxicity of the organic phosphates to humans. They are dangerous if spilled on the skin, swallowed or inhaled. It must be remembered that steam from hot water in which clothes contaminated with organic phosphates are being washed, can be dangerous if inhaled.

Creosote

Creosote is normally used for preserving timber. Poisoning may result if stock obtain sufficient of the material by licking freshly treated woodwork or, more particularly, by consuming creosote left in pools at the base of poles.

Affected animals are often found dead, but if seen before death they show a staggery gait, grunting respiration, abdominal pain and scouring with some signs of bloat. The skin and lining of the mouth may be bluish and the eyes bloodshot.

On post mortem examination the lining of the paunch strips off easily, the fourth stomach is inflamed and the small intestine is an angry red colour, full of gas and may contain partially digested blood. The liver has a stippled or mottled appearance. Treatment is successful only in early cases. Raw linseed oil or Epsom salts may be helpful, giving cattle 2 pt. of raw linseed oil or 1 lb. of Epsom salts and sheep 4 to 6 fl. oz. of raw linseed oil or 3 oz. Epsom salts. Up to 2 pt. of milk or the whites of 6 to 12 eggs are useful.

Salt

Common salt can be poisonous if excessive quantities are eaten. Under field conditions sheep and pigs are the animals most commonly affected, and poultry also are susceptible. Water accumulating in salt troughs in dry weather is at times a source of trouble, and stock receiving insufficient

water are particularly susceptible. Salt poisoning develops rapidly. Symptoms start with a twitching of muscles. With animals this develops into staggering, weaving or circling. Blindness may develop. Convulsions are rare except in pigs, in which spasms occur regularly. Such spasms commence at the snout and progressively move back until the whole body is involved. The pig then often runs rapidly backwards to sit down dog-fashion or topple over.

Post mortem examination reveals a varying degree of inflammation of the stomach and intestines.

Treatment

Treatment consists of removing the source of salt, providing ample fresh water and, if necessary, helping animals to drink. Intravenous injections of calcium borogluconate are helpful, given at the rate of 5 c.c. of 20 per cent solution per lb. body weight, until the heart beat is normal.

Cyanide (prussic acid)

The usual sources of cyanide are various plants such as couch grass, Johnson grass, Sudan grass, common sorghum, *sorghum almum* and sugar gum trees.

The onset is sudden and marked by slobbering, and a gradual increase in the respiration rate. Very laboured breathing—to the stage of mouth breathing—occurs in 5 to 15 minutes. There is a considerable struggling and staggering before the affected animal goes down. Death occurs during very marked convulsions, and after a period ranging from 10 to 30 minutes. Affected animals which survive for two hours usually recover.

Post mortem examination reveals bright red blood which fails to clot. The paunch is distended with gas which may smell of bitter almonds.

Treatment

Treatment consists of intravenous or subcutaneous injections of a mixture of sodium nitrite and sodium thiosulphate, and sodium thiosulphate should be given by mouth or injected into the rumen to fix the free prussic acid in the rumen.

The intravenous injection dose rates are as follows:

	Cattle	*Sheep*
Sodium nitrite	3 grammes	1 gramme
Sodium thiosulphate	15 grammes	2.5 grammes
Water	200 c.c.	50 c.c.

The subcutaneous injection dose rates are:

	Cattle	*Sheep*
Sodium nitrite	3 grammes	1 gramme
Sodium thiosulphate	15 grammes	2.5 grammes
Water	30 c.c.	10 c.c.

In the absence of sodium nitrite and facilities for intravenous injection, stock may be given sodium thiosulphate (hypo) by mouth as for arsenic poisoning.

In all cases, a subcutaneous injection of sulphuric ether 10 c.c. for cattle and 5 c.c. for sheep is recommended.

Nitrates and nitrites

Cases occur when livestock graze variegated thistle, oats and herbages with a high nitrate content. Some hormone-type weed killers increase the nitrate content of plants for some days after spraying, so that stock should be withheld from treated pasture during this period.

Symptoms appear suddenly, and laboured breathing is the first sign, becoming increasingly severe. Weakness and staggering follow, ending in convulsions and death, often within 1 hour, but usually in 3 to 4 hours. Animals which do not die may take 10 to 14 days to recover fully, and pregnant females may abort following recovery.

On post mortem examination the blood is chocolate brown and there are haemorrhages on the surfaces of most internal organs.

Treatment

Treatment is best carried out by injecting a 4 per cent solution of methylene blue intravenously, although subcutaneous injection may be useful.

Dose rates are as follows:

	Cattle	Sheep
Methylene Blue	4 grammes	1 gramme
Water	100 c.c.	25 c.c.

Sodium chlorate

Sodium chlorate is used to kill weeds and can be a hazard to grazing animals. It is unlikely that animals grazing on treated pastures would eat sufficient to produce illness, but it is dangerous to permit salt-hungry stock to have access to the chemical in any quantity.

Toxic doses interfere with the oxygenation of the blood and cause irritation of the stomach and intestines. As a result, affected animals show laboured breathing and possibly also diarrhoea. Urine passed is usually very dark.

On post mortem examination the blood, muscles and organs are very dark and there are deep, black ulcers in the lining of the fourth stomach and small intestine. Urine in the bladder is deep brown.

Treatment

Treatment of this condition is not very satisfactory. Methylene blue, at the dose rate given for nitrite poisoning, may help; it must be given at frequent intervals. Copious blood transfusions or intravenous physiological saline given in large quantities by a veterinarian may be helpful.

Sodium fluoroacetate ("1080")

Sodium fluoroacetate is a colourless, odourless, tasteless chemical used for rabbit destruction and its distribution is strictly controlled. It is highly poisonous to all animals. It produces its effects in two ways, firstly by over-stimulating the central nervous system and secondly by affecting the action of the heart. The first symptoms to appear are nervousness and restlessness. Vomiting occurs in pigs, and both pigs and dogs quickly develop tetanic convulsions similar to those seen in strychnine poisoning. Other animals develop depression and weakness with a very rapid pulse. Death is caused by heart failure.

Cases of poisoning in stock have occurred following the eating of baits, which have become desiccated and then moistened by a shower of rain. This may occur months after the laying of the bait.

Treatment

Treatment is difficult, but dogs and pigs can be given common salt and mustard to produce vomiting as described for strychnine poisoning.

Intravenous injections of barbiturates, by a veterinarian, may be helpful if given within ½ to 3 hours after the poison is taken.

PRECAUTIONS

To reduce the risk of poisoning in stock the following precautions should be taken:

- Burn or bury disused containers of toxic materials together with unused residues or washings.
- Keep poisons not in use on shelves in a securely locked cupboard or room.
- Prevent stock from having access to areas treated with toxic materials or to rubbish dumps where poisons could be present.
- Study carefully the directions for the administration of drugs or the application of insecticides.
- Where a pasture or a crop is of doubtful safety, turn in a few animals in advance of the main mob. These should be observed for the period within which toxic symptoms can occur. This particularly applies in the case of the Sorghum family.
- Have unknown weeds, which could be toxic, identified.
- Do not allow stock access to garden prunings as these are often poisonous.
- Do not assume that because stock have never eaten certain known toxic plants, they will not do so in the future.
- Remember that many poisons are dangerous to persons handling them, either by accidental ingestion, inhalation or contamination of the skin.
- Take extreme care to protect children and farm or station dogs from poisons.

A chance seedling that became our best canning variety

The Golden Queen Peach

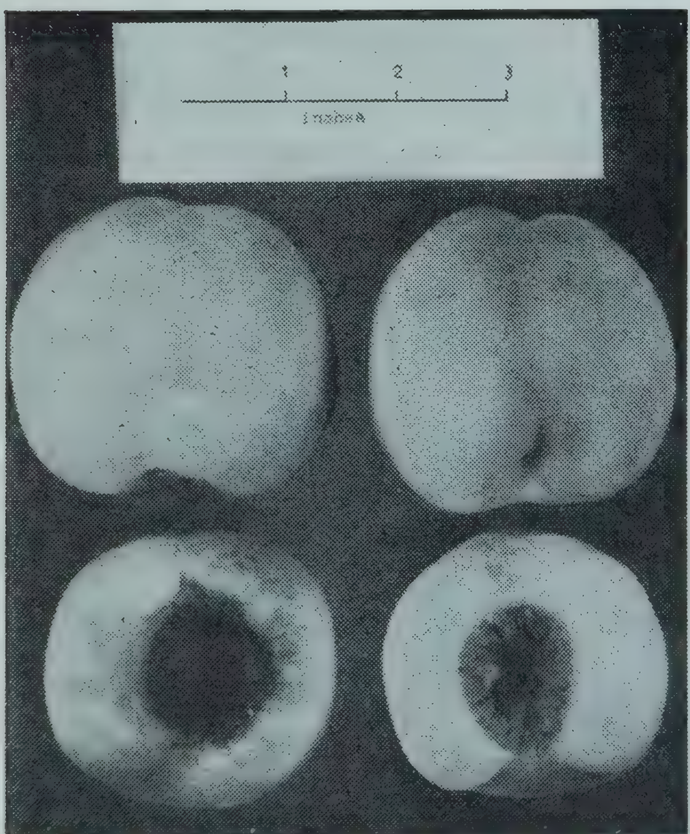
H. D. R. MALCOLM

THE GOLDEN QUEEN clingstone peach is by far the most widely grown and economically important canning peach in New South Wales today. Plantings comprise some two-fifths, or 40 per cent, of the total canning peach plantings in the Murrumbidgee Irrigation Areas (M.I.A.). These areas in turn represent the largest and most important clingstone peach producing areas in New South Wales, supplying about 96 per cent of all peaches processed in this State.

Origin

Golden Queen originated purely through chance seedling selection on a property at Gate Pa, Tauranga, New Zealand, some 50 years ago. An Auckland nurseryman realised the potential of the seedling tree and propagated some buds. After this, and on payment of £25, the budwood became the nurseryman's property, and the original seedling tree was destroyed.

The Golden Queen is now said to be the heaviest cropper of any peach variety in New Zealand. It is a strong grower, crops



Golden Queen peach fruit. Its excellent qualities suit grower and processor alike.

The Author: Mr. H. D. R. Malcolm, Fruit Research Officer, Agricultural Research Station, Yanco.

early in its life, and continues to do so for a long period. It is an easy tree to prune and keep in good condition, is hardy, and reasonably disease resistant. From the processors' point of view there is still no other variety to take the place of the Golden Queen. The New Zealand performance of Golden Queen has perhaps been surpassed in New South Wales, where it thrives better than any other canning peach variety.

At the present time it is safe to say that no canning peach variety evolved in New South Wales has such outstanding characteristics to please both grower and processor alike. This is why we find an average of two out of every five cans of clingstone peaches processed in New South Wales today to be Golden Queens.

Selection of new canning peach varieties is often from chance seedling selections, and some notable new varieties have evolved this way, but as yet none so prolific as Golden Queen.

The fruit

The typical Golden Queen peach fruit is deeply and evenly coloured rich golden-yellow, is juicy, pleasant tasting, and of crisp texture. It is a clingstone peach suited for sale on both fresh, and canning fruit markets. The fruit shape is almost spherical, with very little suture bulge or protruding tip at the stylar end. The peduncle depression, where the fruit stalk is attached, is shallow compared with most peach varieties. The pit, or stone, within the fruit is centrally placed, of relatively small size, and produces no red pigment to discolour the surrounding fruit tissue. All these characteristics are important in good quality canning peaches.

When mature, the Golden Queen fruit hangs well on the trees. This allows only a light premature fruit drop compared with most other, particularly early maturing, canning varieties. The average mature fruit size produced by Golden Queen trees in the Yanco Agricultural Research Station orchard is 70 mm., or seven millimetres above the minimum (63 mm. or $2\frac{1}{8}$ in.) acceptable canning size. Golden Queen matures mid-season. March 13 has been recorded at Yanco as the average peak maturity date in a range extending from the 10th to 22nd March.

The processed fruit

Quality criteria for canned peaches in New South Wales have been determined by canning peach conferences attended by research workers and industry representatives engaged in this field. A rating system has been devised and quality standards set by assessing panels at these conferences. For example, quality determinations are made on canned fruit colour, shape, texture, flavour, pit cavity, and syrup. In their separate categories, a good colour is uniform, bright, golden (deep or light according to individual preference), with absence of green tinge. A good fruit shape requires that the fruit halves retain their cup shape, be symmetrical, and possess thick flesh. Texture must be firm, fine, and crisp; as opposed to mushy, hard, coarse, leathery, or tough. Flavour refers to palatability as determined by individual taste. The cavity within the halved fruit should be small and completely free from red or brown pigment or discolouration, while the syrup enclosed with the canned fruit should be clear and bright as opposed to cloudy, coloured, or containing particles of peach tissue.

The following table shows the ratings assigned to Golden Queen and two other canning peach varieties, Pullar and Halford, compared with the maximum possible ratings. These ratings were determined by the 1960 canning peach conference held at Yanco Agricultural Research Station.

Canning Quality Ratings

	Maximum Ratings	Golden Queen	Pullar	Halford
Colour	25·0	23·5	13·5	11·0
Shape	15·0	11·1	12·3	7·8
Texture	25·0	18·5	13·5	14·5
Flavour	25·0	18·0	12·5	13·0
Cavity	5·0	4·3	3·8	3·9
Syrup	5·0	4·3	4·5	3·9
Totals	100·0	79·7	60·1	54·1

The Golden Queen rating, although not extremely high, was surpassed only by three new varieties still being tested. These new varieties however, may not have satisfactory field characteristics and so prove unsatisfactory for commercial planting recommendation. Conversely, the Pullar variety, second to Golden Queen in commercial acreage planted to canning peaches in the M.I.A., is a good growers' peach. It crops and sizes well but provides a poor processed product. The Golden Queen canning rating then, of 79.7, which could be regarded as 80 per cent perfect, further illustrates the outstanding characteristics of this variety, from both processors' and growers' points of view. The Golden Queen total rating is commonly used as a canning quality standard against which quality characteristics of other canning peach varieties may be judged.

Plantings and characteristics

Golden Queen plantings occupy some 1,760 acres of the 4,611 acres planted to canning peaches in the M.I.A., far more than the nearest rival variety, Pullar, which occupies some 1,046 acres. The Pullar variety however, is no longer recommended for further planting owing to its undesirable reddish colour in the fruit tissue around the stone and prevalent green colour around the shoulder of the fruit.

Mature Golden Queen peach trees satisfy the growers' demands for good cropping from year to year, and on good light soil types in the M.I.A. marketable crops averaging 13 tons per acre are common. This average compares favourably with what is currently regarded as a highly efficient U.S.A. canning peach production average of

Growth habit of the Golden Queen peach tree in the M.I.A. Mature trees average 20 ft. in height, and about the same in spread when 12 years old.

between nine and eleven tons per acre. In the U.S.A. the main canning peach variety is Halford. This variety, tested here in New South Wales at Yanco Agricultural Research Station, for eight years yielded an average of only one marketable ton of fruit per acre. The Halfords at Yanco however, were grown in a heavy soil type, typical of many old orchards in the M.I.A., and hence the comparatively lower yields than in the United States. By comparison, Golden Queen included in the same trial on the heavy soil type outyielded Halford under identical conditions, and produced an average of eight marketable tons of fruit per acre. The Pullar variety in the same trial yielded an average of four marketable tons of fruit per acre. As far as is known, Golden Queen is not at present grown to any large extent in the U.S.A., so that its relative performance there cannot be assessed.

All canning peach trees in the M.I.A. are trained to a vase shape to allow plenty of light to enter the centres of the trees. They are normally planted on a square pattern of 22 ft. spacing, thus providing 90 trees per acre. The average mature Golden Queen peach tree measures some 20 feet in height with a spread of about the same when approximately 12 years old.

Golden Queen trees blossom during September, as most canning peach varieties do in the M.I.A., the mean peak blossom date being around September 12. Their blossoms are rather big and showy, with large, light pink coloured petals, and small red sepals. This feature provides striking contrast with blossoms of the majority of current canning peach varieties which produce small, red blossoms.

Young Golden Queen trees will normally commence to bear fruit when two to three years old. Commercially, cropping is usually prevented until the trees are about three to four years of age. This is achieved by removing early fruiting wood so as not to retard tree vigour during initial shaping. Mature Golden Queen trees are good bearers because fruit buds are produced at even spacings along the entire lengths of the bearing laterals.

Very little premature fruit drop occurs on Golden Queens. Yanco results have shown that this drop is some 10 per cent less than the average for all other canning peach varieties so far tested. The same reduced relative percentage also applies to the marketable crop after all deductions, which include fruit drop, undersize fruit, fruit damaged by pests and diseases, hail, and other mechanical damages. ●

Eradicating Tuberculosis from Cattle in N.S.W.

J. S. Healey

PROGRAMME IS WELL UNDER WAY

Tuberculosis is regarded throughout the world as a major disease of cattle. It causes much economic wastage through loss of milk production on the part of badly affected cattle. Tuberculosis also leads to loss of meat through the condemnation of affected carcasses. For these reasons eradication programmes have been commenced in most economically advanced countries.

What is tuberculosis?

Tuberculosis is a chronic infectious disease caused by the tubercle bacillus (*Mycobacterium tuberculosis*). There are three types of tubercle bacilli, the human, bovine and avian types.

People are highly susceptible to the human type, but have varying levels of resistance against the bovine and avian types. Bovine and avian tubercle bacilli do occasionally cause serious disease in people, particularly in children. Similarly cattle, while being highly susceptible to the bovine type tubercle bacillus, possess a resistance against the other types. Pigs are readily infected by tubercle bacilli of both bovine and avian types.

The Author: Mr. J. S. Healey, Principal Veterinary Officer (Extension), Farrer Place, Sydney.

Tuberculosis is characterised by yellowish cheesy abscesses in various organs and lymph glands. Following infection the earliest observed lesions appear in the lymph glands nearest the seat of infection. The most commonly affected organs are the lungs. The liver and udder are the next most frequently affected organs, while the disease is occasionally seen in the spleen and womb.

How tuberculosis is spread

Cattle with lung lesions of tuberculosis may exhale the causal organisms. These organisms may then be inhaled by other cattle nearby. This is believed to be the most common method of spread. Milk, saliva and droppings of affected cattle can also contain tubercle bacilli. Organisms so voided may contaminate pastures, as well as feeding and drinking troughs, leading to infection of other cattle.

Feeding troughs can be a serious means of spreading tuberculosis in a herd in which there are affected cattle. These troughs are often sheltered from sunlight. When wet from moist feed and cattle saliva they provide an environment well suited to the persistence of the tubercle bacillus.

Calves and pigs may contract the disease through drinking infected milk. In fact this is the most common method by which tuberculosis is spread to pigs.

How tuberculosis is diagnosed

Suspicion of tuberculosis may be aroused when cattle cough and lose condition. Swellings in the head region caused by enlarged lymph glands may also be indicative of the disease. However, each of these manifestations, while commonly caused by tuberculosis, may be caused by something else. Furthermore, most affected cows show no symptoms whatever. Therefore the only reliable method of diagnosing tuberculosis is by the tuberculin test.

Regulations under the Stock Diseases Act restrict the use of tuberculin test to registered veterinarians. The test is made by injecting a small dose of tuberculin into the skin of the tail fold. The result is usually read on the fourth day when infection is indicated by a characteristic swelling at the site of the injection. The tuberculin used is prepared from cultures of the tubercle bacillus. The organisms contained in the cultures are destroyed by heat, and the solution is concentrated and purified.

There are also tuberculin tests based on injections of tuberculin followed by the recording of the temperature of the injected animals. A rise in temperature is evidence of tuberculosis. These tests are mainly used as check tests in special circumstances.

Tuberculosis eradication overseas

United States. The first nation to embark on a comprehensive eradication programme was the United States. Testing commenced in 1917. The work was undertaken by practising veterinarians, and the organisation was a co-operative effort between Federal and State Governments. Testing was on an area basis and when the incidence of reacting cattle in an area was reduced to 1 in 200, the area was declared to be a "Modified Accredited Area". By 1941 all areas had reached this status and only 1 in every 1,000 cattle reacted to the test. After the War there was a reduction in the volume of testing and by 1959 the incidence of reactors had doubled. However, subsequently, the figure was reduced to 1 in 1,000 cattle.

United Kingdom. Area eradication commenced in 1950. Herds which were tested on three occasions with negative results, were classified as "Attested Herds". Owners of such herds were entitled to a bonus payment on all milk produced. When all herds in an area had become attested the area was classified as "Attested". By 1960 all areas had reached this status and by 1963 only 1 in every 1,400 cattle tested was a reactor.

Other countries. Countries in which eradication programmes have been conducted include the Netherlands, Denmark, Finland and Canada.

Early control in New South Wales

For many years the Department of Agriculture has maintained the voluntary Tubercle-free Herd Scheme. Schemes involving the testing of herds supplying milk for city and town consumption had also been implemented in conjunction with the New South Wales Milk Board and municipal and shire councils.

In 1953 the Cattle Compensation Act was implemented. It provided an indemnity for cattle condemned for tuberculosis and certain other diseases. This legislation stimulated much voluntary herd testing. Large numbers of stockowners engaged practising veterinarians to do this work. At the same time as much testing as possible was also undertaken by veterinary officers and veterinary inspectors of the Department. These officers concentrated on those herds in which there was clinical evidence of infection. In 1957 a policy was initiated whereby herds found to be infected with tuberculosis were quarantined until tested. During the period 1953 to 1959, 659,584 cattle were tested with the detection of 31,482 reactors.

There is no doubt that this testing, concentrated as it was on the most heavily infected herds, had a significant impact on the overall level of infection before the commencement of eradication. The total number of cattle tested during this period was about half the number subsequently tested under the eradication procedures.

But the number of reactors detected was some three times that found in eradication testing.

Eradication in New South Wales

Eradication of tuberculosis on an area basis was commenced in 1960. The programme involves the gazettal under the Stock Diseases Act of quarantine areas in which all cattle are required to be tested. Local administration of the scheme is the responsibility of district veterinary officers. Except for re-tests of infected herds, testing is carried out by approved practising veterinarians. To be approved for this work practitioners are required to enter into agreement with the Department to observe certain conditions. They must also demonstrate their proficiency in performing the tuberculin test. Cattle inspectors have been appointed to organise testing on individual properties and to value reactors for compensation. Pastures Protection Board rangers also participate in this work.

Veterinary practitioners brand reactors on the right side of the face with the letter "R". They must immediately report particulars of testing to the district veterinary officer. Arrangements are then made for reactors to be valued and forwarded for slaughter. Herds in which reactors are found are re-tested three months after the previous test. Re-tests are carried out by departmental veterinary officers or Pastures Protection Board veterinary inspectors. If there are further reactors, re-testing is continued at three-monthly intervals until the herd is apparently free from infection.

Private veterinarians annually test all herds in each quarantine area, until the number of reacting cattle falls below 1 in 200. Testing is then performed at two-yearly intervals. In many areas fewer than 1 in 200 cattle have reacted during the first year of testing. Such areas are not then tested for two years.

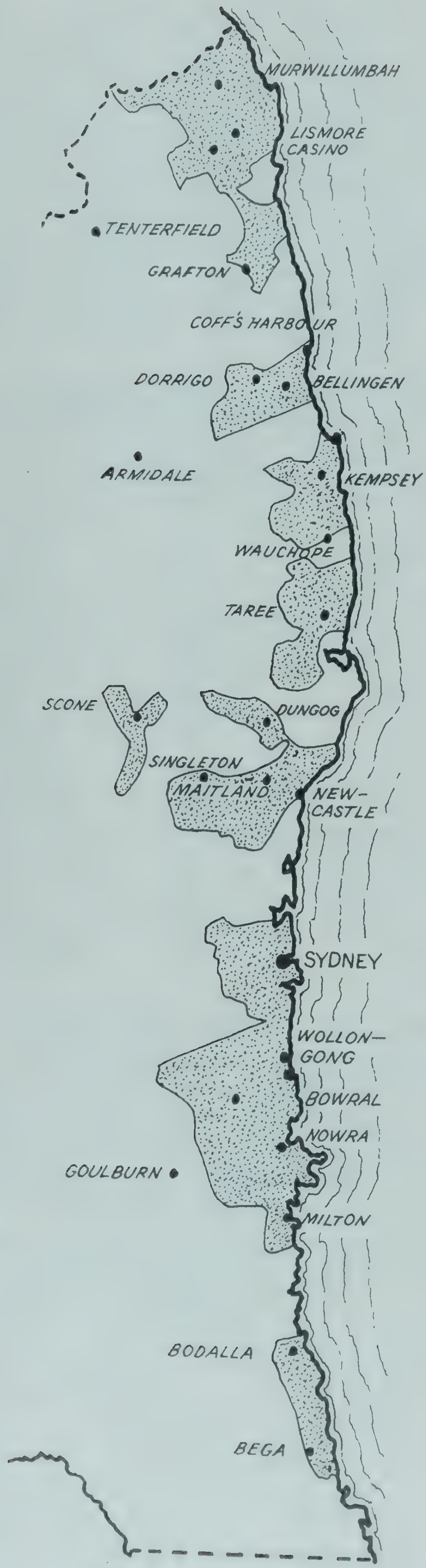
The first area established was the Illawarra Area immediately south of Sydney and in the Moss Vale Pastures Protection District. It contains approximately 60,000 head of cattle. Additional quarantine areas have since been brought into being. Such areas now number 52 and contain approximately 1,006,000 cattle. Particulars of quarantine areas and cattle in various pastures protection districts are given in Table 1. The accompanying map also illustrates the distribution of quarantine areas. They now embrace most of the closely settled coastal country as well as some with only a low cattle population. Up to 30 June, 1964, testing had been undertaken in 46 of the 52 areas.

Table 1. Numbers of cattle in quarantine areas in various pastures protection districts.

District	Number of areas	Number of cattle
Braidwood ..	1	6,000
Casino	7	119,000
Denman-Singleton	4	54,000
Eden	2	32,000
Gloucester ..	4	111,000
Grafton ..	8	64,000
Maitland ..	7	104,000
Moss Vale ..	3	178,000
Port Macquarie	5	65,000
Tweed Lismore	9	255,000
Upper Hunter	2	18,000
Totals	52	1,006,000

Eradication testing requirements in quarantine areas apply equally to dairy and beef cattle. However, in most areas dairy cattle predominate. Nevertheless some areas contain 50 per cent. or more beef cattle. The number of cattle in individual areas varies from 2,000 to 80,000.

A summary of eradication testing carried out from 1960 to 1964 is furnished in table 2. In areas tested for the first time, 1 in every 75 cattle has reacted. The incidence of reactors in individual areas has varied from 1 in 21 in the Illawarra Area to 1 in 600 in the Stewart's River Area on the mid-north coast. In herds given a second series of annual tests, 1 in every 370 head of cattle has reacted, while in herds undergoing a third series of tests reactors have numbered 1 in 430.



TB. eradication areas.

Table 2. Particulars of quarantine area testing to 30 June 1964.

Year	Areas	Cattle tested	Reactors	Reactors (per cent)
1959-60 ..	1	10,500	394	3·75
1960-61 ..	6	135,488	2,319	1·71
1961- 2 ..	10	204,702	1,198	0·59
1962- 3 ..	26	341,380	2,603	0·76
1963- 4 ..	46	635,527	3,460	0·54
Totals ..	..	1,327,597	9,974	0·75

Compensation

Compensation under the Cattle Compensation Act is paid for all reactors to the tuberculin test. Reactors are slaughtered at abattoirs under the supervision of meat inspectors. Compensation is based on the market value, less the residual carcass value. In the absence of agreement between the owner and the inspector as to the value of a reactor, a determination is made by a specially appointed third party. Where tuberculosis is detected on slaughter, compensation is such that the amount so paid, together with the residual carcass value, equals seven-eighths of the market value. If no tuberculosis is found on slaughter, compensation and residual value total the full market value. In all cases however, market value is subject to the statutory limitation of £50 for any one animal.

No visible lesion reactors

In some cattle which react to the tuberculin test, lesions of tuberculosis are not detected on slaughter. The main causes of this are:

- Very small lesions of tuberculosis are missed on post mortem examination.
- Cattle are infected with human or avian type tubercle bacilli which frequently do not produce visible lesions.
- Cattle have been sensitised by a non-pathogenic organism.

Infection with non-pathogenic sensitising organisms is believed to account for most no visible lesion reactors in New South Wales. Avian tuberculosis is not known to

occur in any eradication area, while few cattle would be exposed to human infection.

During the year 1963-64, 688 of the 3,460 reactors failed to show lesions of tuberculosis on slaughter. Thus no visible lesion reactors constituted 1 in 5 of all reactors detected during this period. However they represented only 1 in every 900 cattle tested.

It is recognised scientifically that the proportion of reactors which fail to show lesions is low when large numbers of reactors are being detected, and high when the number of reactors is low. Thus in the United States between 1893 and 1908 when 1 in 10 cattle tested reacted, only 1 reactor in 60 failed to show lesions. However, in 1959 in that country when only 1 in 430 cattle tested reacted, more than half of the reactors did not show lesions of tuberculosis. At both periods the incidence of no visible lesion reactors in relation to total cattle tested was constant, being 1 in 720 and 1 in 770, respectively.

In comparison with American experience, the New South Wales level of no visible lesion reactors of 1 in every 900 head of cattle tested, is by no means excessive.

Conclusion

The extent of condemnation of carcasses of pigs fed on separated milk is an efficient indicator of the incidence of tuberculosis in cattle. During the decade ending 30th June, 1964, there was a tenfold decline in the proportion of pig carcasses both totally and partially condemned for tuberculosis. Figures for pig carcass condemnations over the ten-year period are set out in table 3.

Table 3. Pig carcasses totally and partially condemned for tuberculosis.

Year	Wholly condemned	Partially condemned
	per cent	per cent
1953- 4	0·64	1·80
1954- 5	0·58	2·06
1955- 6	0·52	2·09
1956- 7	0·44	2·44
1957- 8	0·31	2·26
1958- 9	0·24	1·09
1959-60	0·15	0·62
1960-61	0·12	0·48
1961- 2	0·11	0·32
1962- 3	0·08	0·24
1963- 4	0·06	0·16

It is intended to extend the tuberculosis eradication programme by the declaration of additional quarantine areas. The degree of expansion, however, will be limited by the availability of veterinarians to undertake the testing. Owing to a shortage of veterinarians it will not be possible to bring new areas into the scheme at the rate which has hitherto prevailed. ●

Be Careful of Organic Phosphate Vapour

Organic phosphates have become firmly established as efficient agents for the control of external parasites on stock. They must, however, be handled with care. Recently the wife of a grazier had to be rushed to hospital after washing clothing which had become saturated with an organic phosphate. The hot water caused the organic phosphate to vaporise in the steam, which she had inhaled, causing serious illness. ●

College Gold

A NEW CAPSICUM VARIETY

R. Gottl

The Author: Dr. R. Gottl, Research Officer, Hawkesbury Agricultural College, Richmond.

A NEW, yellow fruited capsicum variety developed at Hawkesbury Agricultural College was recently given the name College Gold and released for commercial production.

Sweet peppers or capsicums (*Capsicum frutescens* L) belong to the family Solanaceae, and are thus closely related to tomato, potato, tobacco and egg plant. They probably originated in South America. There are several types, varying from large, mild-flavoured varieties to small varieties having extremely hot flavour. The capsicums most commonly grown in New South Wales are large fruited, mild flavoured types often referred to as sweet peppers. Up to the present the varieties grown have had dark green fruit which at maturity changes to a dark red.

The new variety was developed from selected material supplied by Mr. N. Derera from a cross made in Hungary. Mr. Derera supplied early generation seedlings to the College. College Gold was derived by further selection from this material.

Plants of College Gold are medium tall, reaching 15 in. to 18 in in height. Growth is erect, the lateral branches, which number three to five, arise from the main stem. The relatively small leaves are oblate in shape and medium green in colour. The first fruits are borne among the foliage but towards the end of the season fruits are developed above the foliage also. Fruits are 2½ in.

Left: College Gold plant. Below: Capsicum varieties under trial at Hawkesbury Agricultural College

This table makes obvious the high vitamin C content of capsicums compared with that of other fruit and vegetables and also the particularly high level of this vitamin in the yellow fruited types.

Fruit or vegetable	Percentage solids	Vitamin C net weight in milli-grams per 100 grams of fruit
Lemon	11·7	45
Orange	12·8	49
Apple..	15·9	5
Carrot (fresh)	12·4	10
Potato	22·2	24
Beans (snap)	11·1	19
Peas (fresh)	25·7	26
Tomato	5·9	23
Capsicum (U.S.A.) Market Stage	7·6	120
Capsicum (H.A.C.) Market stage		
Large green	6·40	75
Yellow .. .. .. (College Gold)	6·40	150
Capsicum (H.A.C.) Fully ripe stage (Red)		
Large green	8·94	167
Yellow .. .. (College Gold)	8·47	183

to 3 in. long, 2 in. to 2½ in. in diameter at the base, and taper to a point. At the early market stage the fruit is creamy or light yellow; later it turns bright red. The smooth, shiny skin has a heavy, waxy bloom. The fruit has thick walls with fine textured flesh of pleasant, sweet flavour. There are 3 to 4 locules or cells to each fruit and each contains a moderate amount of seed.

College Gold matures early, being 10 to 14 days earlier than most of the present commercial varieties. It can produce for long periods, and under favourable conditions will produce fruit for up to seven months. It is quite a hardy variety which withstands dry conditions, sun scald and soft rots.

A feature of yellow fruited capsicums is their high content of vitamin C (ascorbic acid). The table indicates the high content of vitamin C possessed by College Gold as compared with figures taken from "Nutritional Data" by Wooster & Blank for other fruits and vegetables. (The vitamin C figures for Hawkesbury Agricultural College-grown capsicums were kindly determined by the Division of Food Preservation, C.S.I.R.O., North Ryde.) ●

Wheat Fertilizer Trends in North-western New South Wales

R. J. Esdaile

Over the last few years, dramatic changes have been taking place in many of the agronomic practices of wheatgrowing in north-western New South Wales.

Not least among these changes has been the increasing awareness on the part of many wheatgrowers of the virtues of phosphatic and nitrogenous fertilizers on their soils.

Past and present trends in fertilizer usage

Traditionally, in the past, north-western soils have been thought to be adequately supplied with natural chemical fertility. Dressings of fertilizer on cereal crops and pastures were not thought to be required, and probably in many cases this was correct. Many farmers in past years have tried fertilizer on small areas, received no response and have consequently not considered it further.

Soil samples have been taken in the last few years from various areas by Department of Agriculture officers, and analysed for available phosphate. They have indicated that many virgin soils, or soils very young in cultivation history, have been well supplied with phosphorus, and that fertilizer dressings are not required. However, in many cases long periods of cultivation have

Approximate North-west Fertilizer Sales (tons)

Area	1959–60	1960–61	1961–2	1962–3	1963–4
Moree	..	..	..	150	900
Narrabri	..	..	..	200	700
Boggabri	200	600	650	900	1,000
Gunnedah	..	..	150	200	450
Tamworth	1,400	2,000	2,800	3,800	5,000
Inverell	..	500	500	1,500	5,000

The Author: *Mr. R. J. Esdaile, Agronomist (Cereals), Agricultural Research Station, Tamworth.*

reduced this available phosphorus level to the stage where annual applications of fertilizer are definitely warranted.

Other soils, as indicated by soil analyses and field trials, have never been well supplied with phosphate. These soils, although they are growing good crops, could be growing much better crops with fertilizer.

What has been the trend in sales of superphosphate over the last five years or so?

Examination of records and reports from fertilizer agents and company representatives show a startling picture.

Some examples of this are shown in the accompanying table.

The outstanding point to note is that where five years ago practically no superphosphate was being sold in the north-west, to-day it is a fast expanding outlet with sales increasing two to five fold every year.

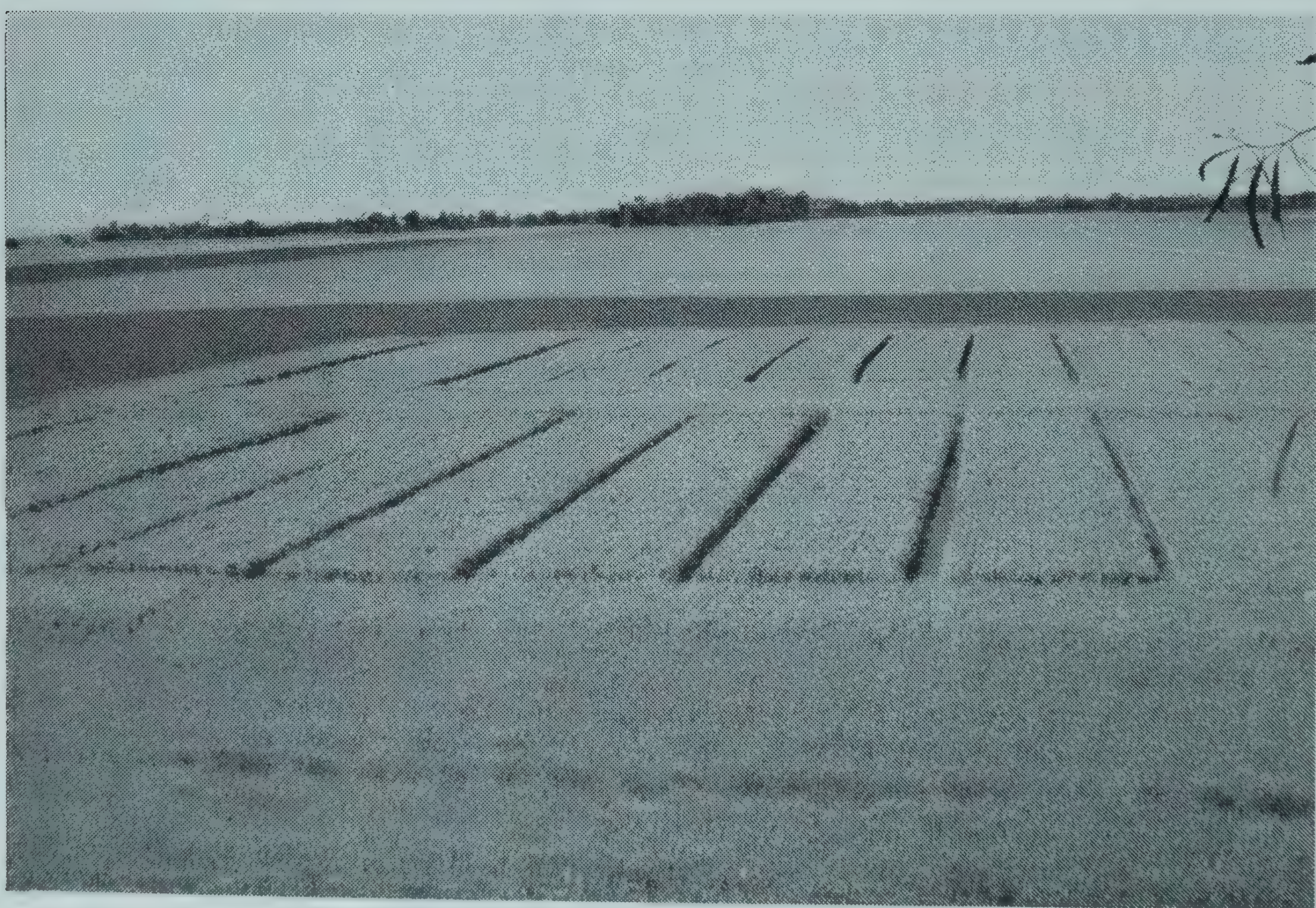
Why has this change come about? There are several reasons.

The last five years has seen the setting up and expansion of two major research establishments; these are examining closely the fertilizer practices and soil fertility of the north-west. There is the north-west Wheat Research Institute at Narrabri, administered by the University of Sydney. The other is the Tamworth Agricultural Research Station, operated by the New South Wales Department of Agriculture.

Both these research stations have shown, by the work being conducted, that cereal responses to fertilizer are very evident in many north-western soils.

Also, there have been the various studies undertaken by Department of Agriculture extension agronomists, in which they have examined cereal responses to fertilizer in independent work. They have also conducted a great many pasture fertilizer trials as a section of the State-wide Uniform Pasture Survey Trials.

Work has also been undertaken by various private advisory agronomists as well as concentrated research and extension by the technical and research staffs of the fertilizer companies.



Superphosphate trial on a property at Milguy

Response to superphosphate in plots at Tamworth Agricultural Research Station

The £3 per ton subsidy, introduced by the Federal Government in 1963, has induced many farmers who were previously applying small amounts of fertilizer, to increase their rate of superphosphate application.

What can be expected in the future?

As indicated in the table, five years ago probably only several hundred tons of superphosphate were used on cereals in north-western N.S.W. However, in 1964 a rough estimate might be that 6,000 tons of this fertilizer were applied to cereals. (This is allowing for the fact that probably much of the fertilizer sold in Tamworth and Inverell is used for topdressing improved pastures.)

From practically nothing to six thousand tons in five years is a really astronomic rise, but surely the area is only on the edge of a plunge into one of the greatest changes ever known.

Two distinct elements, phosphorus and nitrogen, are of prime importance and will be dealt with in turn.

Phosphorus: The main fertilizer used to supply phosphorus is superphosphate, which contains 22 per cent soluble phosphorus pentoxide. Superphosphate has been the most important fertilizer in Australian agriculture, ever since it was first used in Southern Australia in the 1890's.

Phosphorus has only been studied closely in the north-west over the last few years with first of all a study of the Tamworth-Manilla-Barraba district by Mr. D. L. Jackson of Sydney University. Some work in this field has also been done by Mr. R. Fawcett of the North-west Wheat Research Institute at Narrabri. Since 1961 a study has been in progress by the author in co-operation with Dr. J. D. Colwell, of the C.S.I.R.O. Division of Soils, Canberra.

The results to hand of much of this work indicate that many soils of the north-west require a dressing of superphosphate to increase their production.

Trials have been conducted from Tamworth through to Croppa Creek, westward

to Coonamble and eastward to Inverell. The field results are being examined along with laboratory analyses and a pattern of fertilizer response correlating with soil analysis is emerging.

Trials of the type illustrated in figure I are sown with superphosphate rates of 0, 50, 100, 200 and 400 lb. per acre. Nitrogen fertilizer is also added to some plots. Yields are taken at harvest time and soil samples are also taken from the site.

These field and laboratory results from the many trials conducted are then used to ascertain the overall trend of the study.

Nitrogen. Nitrogen is becoming increasingly important in the north-west, especially in soils that are light in texture or becoming old in cultivation history.

Study of nitrogen responses was conducted in the Tamworth area by Mr. D. L. Jackson, of Sydney University. More recently, a broader study has been undertaken by Mr. Peter Gardner, Research Agronomist with Australian Fertilizers Ltd.

Mr. Gardner's study has extended from Tamworth through to Moree and also embraces much of the central-west. In all, 52 trials were conducted during 1963, with good, payable responses to nitrogen fertilizer in some cases.

The study was continued along the same lines during 1964.

With the large quantities of field data now being gathered, and greater experience of nitrogen fertilizers, farmers will in time be able to apply these fertilizers with confidence to those areas which can economically give a response.

Probable trends in fertilizer usage

As shown in table 1, the north-west is only just awakening to the possibility of the general use of fertilizers on cereals.

It would be reasonable to assume that another five years could see an increase practically as great as that already experienced. Many farmers are at present applying light rates of superphosphate to cereals. After several years of this, many should be considering increasing their application rates to gain the maximum profit from the fertilizer.

As pointed out in recent observations in Milguy, continual application of phosphate fertilizers will lead to a general build-up in phosphate fertility. This is just as sure as that continual cropping with no fertilizer addition leads to a decline in phosphate fertility.

Where a good response to phosphorus and also nitrogen is being obtained, applications involving the use of heavy rates of both elements are seemingly a problem. But this should be overcome satisfactorily by the recent introduction of high analysis and mixed fertilizers. These fertilizers, being more concentrated carry less inert material in their makeup, and thus freight costs per unit of nutrient are lower. Also handling and cartage of the fertilizer on the farm is less irksome, as light rates of high analysis fertilizer supply large quantities of nutrient to the crop.

Large-scale production of these fertilizers will probably not be undertaken in the near future. This is because the manufacturing plants are fully occupied in covering the current increase in superphosphate demand. They can devote little time to a concentrated effort to produce these specialised products which require the development of particular manufacturing processes. However, as higher fertilizer rates become more popular and supplies meet the increased demand these concentrated mixtures will come into their own as a partial solution to the handling problem.

With continued Government support and increased farmer awareness of fertilizer benefits, it would be fair to say that within the next five years, the north-west should be using 15,000 to 20,000 tons per annum. As has been seen overseas, adequate research results, coupled with farmer education on this problem, can lead to greatly increased productivity from the maximum economic use of fertilizers.

Within the next year or so it is hoped that the soil phosphorus analysis service as at present operating in the Riverina will be

extended to the north-west. This technique was developed by Dr. J. D. Colwell of the C.S.I.R.O. Division of Soils, and is at present being recalibrated for the north-western soils. It is expected that before next season many north-western soils will be extensively sampled. This will be done by means of a pilot scheme run by Tamworth Agricultural Research Station. The staff will sample and analyse soils from many properties, and the farmers will then be advised of the phosphate status of their soils. Where necessary, superphosphate application rates for wheat on particular paddocks will be given. Farmers will be encouraged to test the validity of recommendations by means of trial strips.

It is claimed in Canada that the use of soil testing has raised average wheat yields from between 30 and 40 bushels per acre to 80 to 100 bushels per acre, by consistent heavy annual dressings of mixed fertilizers. Will this be the story in the north-west?

What can be done

Results of investigations indicate that every cereal farmer in the north-west should be trying phosphatic and nitrogenous fertilizers on his land. Generally speaking the days of continuous cropping without fertilizer over long periods have gone.

Those who intend purchasing fertilizer are urged to do so early, as the increased demand in this area as well as in other zones of the State, indicate that the fertilizer shortage will be with us for some years to come.

Experiment with trial strips of phosphatic and nitrogenous fertilizers to gain a quantitative estimate of the response of your crops.

When purchasing sowing equipment make sure that fertilizer boxes are fitted.

Keep in touch with your local district agronomist and fertilizer agent to keep abreast of developments as they happen.

If you are generally using fertilizers on your property, fully investigate the possibility of the application of higher rates to overcome more quickly the deficiency and to build up a chemical fertility reserve in the soil. Remember that consistent annual applications mean a generally higher crop yield every year. •

Livestock Health Notes

J. S. Healey

CARBON TETRACHLORIDE POISONING

For many years the reason why carbon tetrachloride occasionally caused heavy mortality when used for drenching sheep was a puzzle to scientists. Thanks to the observations of Dr. C. H. Gallagher of the C.S.I.R.O., it is now known that slow swallowing is one factor which may make carbon tetrachloride toxic.

The speed with which a drench is swallowed is influenced both by drenching technique and by the type of drenching gun used. A gun with a long, flexed spout, the end of which can be inserted over the back of the tongue, is conducive to quick swallowing. An oesophageal tube connected to a drenching gun has the same effect. On the other hand, a drench is swallowed slowly if squirted against the roof of the mouth. Deposition of the drench in the space between the molar teeth and the cheek gives a rate of swallowing intermediate between the two types of drenching already mentioned. Swallowing is rapid also if the fingers of the free hand are inserted in the inter-dental space while holding the sheep's head for drenching.

It is necessary to sound a note of caution in regard to the use of drenching guns with long spouts or oesophageal tubes. Experience is necessary before these instruments can be successfully used. Their unskilful use can cause damage to the lining of the mouth and throat, with subsequent infection and mortality.

Another of Dr. Gallagher's findings is that certain materials such as nicotinic acid or santoquin given at the same time as the carbon tetrachloride, or shortly before, will increase the margin of safety. A further interesting sidelight has been thrown on the subject by work at the Department's Veterinary Research Station, Glenfield. This work has shown that stinkwort and the leaves of the Kurrajong tree, when eaten by sheep, can increase the toxicity of carbon tetrachloride. It is therefore unwise to use carbon tetrachloride on sheep having access to either species. And of course, don't drench during cold wet weather.

POSTHITIS PELLETS FOR WETHERS

If wethers are grazing on clover pastures keep a lookout for the possible development of posthitis. This condition has also been known by other names, including balanitis, sheath rot, and pizzle rot. Until recently it was often referred to as non-contagious posthitis. However the word "non" had to be hastily dropped when the C.S.I.R.O. discovered that the disease was in fact contagious.

Although posthitis is now known to be caused by a bacterium, a high ammonia content in the urine is a strong predisposing factor. Grazing on clover increases the ammonia content of the urine. Resistance to the disease is promoted by the male sex hormone. For this reason the disease is not a problem in rams.

Testosterone pellets afford a high level of protection against posthitis. They act similarly to the male sex hormone of rams and are implanted under the skin of the ear towards its base by means of a special gun. Under most circumstances, pellets containing 70 to 90 milligrams of testosterone propionate inserted in autumn and spring will give protection throughout the year. Where posthitis is severe, three separate implantations, one in autumn, one in winter, and another in spring, may be warranted.

A single insertion is usually effective for about three months.

Testosterone pellets frequently increase growth rate and wool production. However these effects are not sufficiently marked to justify the use of the pellets for this purpose alone.

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PREVENTING SHEEP BLOWFLY STRIKE

For many years sheep have been jetted with insecticides for the prevention of blowfly strike. Jetting has the disadvantage of disturbing the fleece, particularly when used to prevent body strike. To see if another method of application would be suitable, Messrs. A. N. Sinclair, A. J. F. Gibson and W. A. Cavey recently compared the efficiency of diazinon applied by surface spraying, showering and jetting. Their work was reported in the *Australian Veterinary Journal.*

The number of fly strikes recorded during the ten weeks after treatment was three times as great in the sprayed sheep as in those jetted. The showered group showed only one-fourth the number of strikes of the jetted sheep. However, each showered sheep received an estimated deposit of diazinon three times greater than the jetted group, so that this comparison is not wholly valid. A different result may have been obtained if the jetted sheep had received the same quantity of diazinon as the sprayed sheep.

Having regard to the results obtained, the cost factor and the staining of wool resulting from showering, the authors conclude that jetting remains the method of choice for applying diazinon to sheep for the control and prevention of blowfly strike.

STRAIN 19 VACCINATION FOR CALVES

Calves born during spring should now be ready for inoculation with strain 19 vaccine as a protection against brucellosis. There have been some contradictory results obtained by different research workers as to the minimum age at which calves can be vaccinated. Some workers have suggested that calves vaccinated at younger than six months of age may not build up a strong immunity. Other workers however have found no difference in immunity between calves vaccinated at four months and those vaccinated at six months. Until the issue is finally clarified it is probably best to wait until calves are six months old. Where, however, a delay would pose difficulties, animals may be vaccinated as young as four months.

The efficiency of strain 19 vaccine has been fully established by much experimental work. One such experiment was carried out by the C.S.I.R.O. in Australia. Although it is a number of years since the work was performed, the results were so striking as to bear repetition. Twenty-seven first calf heifers which had been vaccinated as calves were placed with 29 unvaccinated heifers of similar age in a paddock contaminated with the causal organisms of the disease. Of the vaccinated heifers only one subsequently reacted to the test for brucellosis and this heifer aborted. Of the 29 unvaccinated heifers, 10 aborted and 18 subsequently reacted to the test.

In California over an eleven year period the systematic use of strain 19 vaccine reduced the incidence of brucellosis in dairy cattle from 17 per cent to 2 per cent, and in beef cattle from 7 per cent to 0.7 per cent.

CATTLE PREGNANCY DIAGNOSIS POPULAR

On an increasing number of beef cattle properties, pregnancy diagnosis is becoming routine. The advantages from this procedure are considerable. Separation of the breeding herd into pregnant and empty groupings enables more economic use to be made of the empty cows. These can be dealt with in one of several ways. They may be sold immediately, fattened, or remated. Empty cows with calves at foot can be allowed to retain their calves past the normal weaning time.

Another advantage of pregnancy diagnosis is that the pregnant cows may be grouped according to the stage of pregnancy at the time of examination. Two or three such groupings can be made. More efficient supervision of the cows at calving time is then possible. Pregnancy diagnosis is best performed two to three months after the cessation of mating. •

The Cost of Owning and Operating A Header

G. F. Donaldson and J. G. Ryan

Modern headers are capable of completing their operations at greater speed, with more safety and less effort on the part of the operators. But these advantages are obtained at considerable extra cost. Headers are a prime example of the trend to bigger, more complex and more expensive farm equipment.

The aim of this article is to help in making decisions about buying a header. These decisions warrant special consideration because this outlay represents one of the largest single items of expenditure on the farm.

Owning and operation costs for several different sized new machines used over different acreages are considered. The total costs have been estimated for each acreage considered and the cost per acre calculated and graphed. The curves shown in figure 1 are average cost curves related to acreage.

Components of cost

When making a decision it is necessary to consider both *overhead costs,* and *operating costs.* Overhead costs do not vary greatly from one situation to another and are therefore easy to determine. Operating costs do vary for different locations, for different crops and with how much the machine is used. These are therefore much more difficult to estimate. The figures used here are for wheat crops yielding 25 to 30 bushels per acre. For heavier crops the operating costs per acre may be greater. However, since overhead costs are the biggest single cost item, some variation in the operating costs will not greatly influence a decision on header size.

The purchase price for the machines considered includes rubber tyres, crop lifters, bulk equipment and freight to about 300 miles from Sydney.

It is assumed that the work performance of different makes of machines is equal.

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On the grounds that machinery manufacture is quite competitive, this assumption does not seem unreasonable.

Overhead Costs

Overhead costs include depreciation, interest, insurance and shelter. These costs are incurred regardless of the extent of use of the machine each year. They will, in fact, usually be incurred whether the machine is used or not. But, the overhead cost per acre decreases with increased use. This is referred to as "spreading overhead costs".

Depreciation is the cost resulting from age and obsolescence of farm machinery. Loss of value through wear and tear is allowed for in the repairs and maintenance item of operating costs, since this varies with the amount of use of the machine.

We consider that the active life of a machine in the wheat belt is about eight years. After this time a machine will have some resale value as equipment for farmers with smaller crop areas. Observations indicate the resale price of approximately 20 per cent of the purchase price after operating for eight years. Thus depreciation is estimated as 80 per cent spread over eight years, that is, 10 per cent of the original price per year.

Interest on the capital outlay has been calculated at the rate of 6 per cent per year. This has been charged on the average value of each header because the investment in the machine declines as it depreciates. The average value on which interest is calculated is estimated as

$$\text{Interest} = \frac{\text{purchase price} + \text{estimated resale price}}{2} \times \text{interest rate}$$

For example, with the smallest machine the figures were as follows:

$$I = \frac{1460 + 292}{2} \times \frac{6}{100}$$

$$= \frac{1752}{2} \times \frac{6}{100}$$

$$= £52\ 11s.\ 2d.$$

A rate of 6 per cent has been used, because this approximates bank interest, but the appropriate interest rate to use may be quite different from this. The correct rate of use is the top rate which the capital could earn if used for some alternative farm investment. On many properties this rate may be considerably greater than the 6 per cent used here. If this is so, then these costs curves will underestimate the real cost per acre.

Insurance is calculated on the average value of each machine at the ruling rate of 20s. per £100 insured.

Shelter is an essential cost and if it is not included a higher depreciation rate is appropriate. The annual cost is estimated on a shed capital cost of £200 per square, depreciated over a life of forty years. The area occupied by the header was varied from 2 to 2.5 squares according to the header size.

Operating costs

Operating costs vary with the amount of annual use. They include fuel, lubrication, repairs, maintenance and labour.

Fuel and lubrication are major expenses in operating headers. Since fuel consumption varies according to the size and type of machine it is necessary to calculate fuel costs for each individual machine. In the case of P.T.O. headers, we have considered a 38 to 42 horse power diesel tractor as the source of power. For the auto headers we have estimated fuel costs for the particular petrol engine fitted to each header. Lubrication costs are included but are almost negligible on modern headers with sealed bearings.

Repairs and maintenance have been calculated separately for the header and for the tractor or engine involved. The figure for the tractor includes tyre replacement. No allowance is made for tyres on P.T.O. headers since they are expected to last the life of the machine. Auto header tyres have been costed at the same rate as tractor tyres.

Labour has been included as a cost at the rate of 12s. per hour.

Rate of heading

During heading, fuel and labour costs are incurred on an hourly basis. Thus the cost per acre depends on the number of acres covered per hour. This has been calculated by using the formula:

$$\text{Acres per Hour} = \frac{W \times S \times E}{825}$$

where W = width of the comb in feet,
S = ground speed of the header, and
E = efficiency in terms of time moving as a percentage of total time.

For example, with the smallest header the figures were as follows:

$$A = \frac{10 \times 3.7 \times 70}{825}$$

$$= 3.13 \text{ acres per hour.}$$

In calculating the acres covered per hour we have used an efficiency of 70 per cent for P.T.O. and 80 per cent for auto headers. This is based on observations which showed that a P.T.O. header spent approximately seven hours of a ten-hour working day moving through the crop. This allows 3 minutes in every 10 for off-loading, greasing, adjustments, repairs and any other stoppages. The working time for an auto header was observed as nearer 80 per cent of time in the paddock. Some gain is made by virtue of the greater manoeuvrability of the auto header, and its greater ground speed when moving to and from the field bin.

It should be noted, however, that there is a very wide variation in the efficiency of header operation associated with the experience and ability of the operator, and the conditions in which he is operating. Thus for an experienced driver in good conditions these efficiency percentages will be conservative, though not unrealistically so.

Total costs

Total costs are calculated by adding together the overhead and operating costs per acre for each acreage level considered. These costs are shown in tables 1 and 2, and are graphed in figure 1.

The costs shown in table 1 indicate the high overhead costs associated with owning a large header. It is important to realise that the total overhead cost is incurred regardless of the amount of work

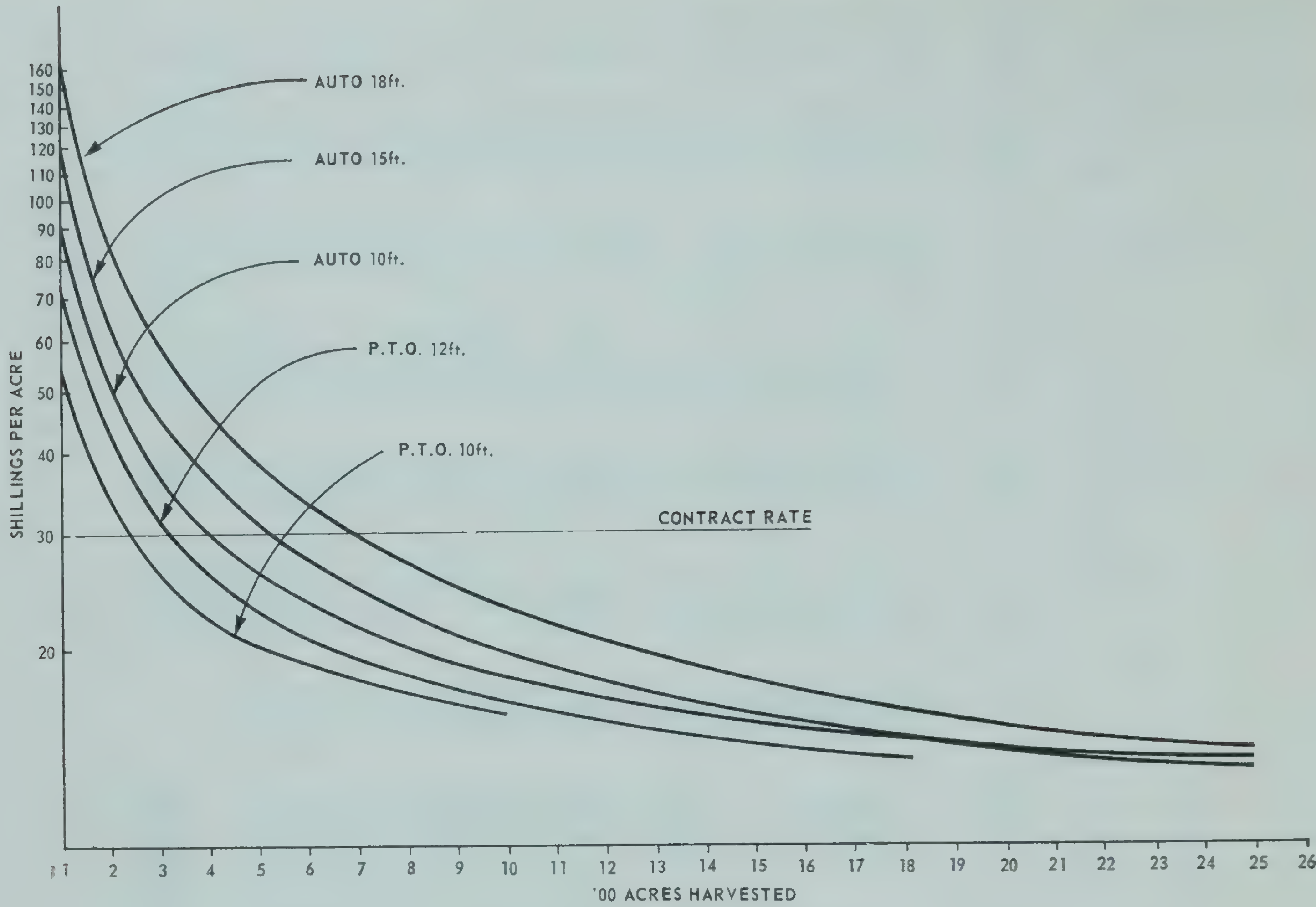
Table I. Overhead and Operating Costs

Header type	Comb width	Ground speed	Acres hour	Overhead costs, per year					Operating costs per acre					TOTAL
				Dep'n.	Interest	Insurance	Shelter	Total	Fuel and motor lub.	Motor rep. and maint.	Header lube.	Header rep. and maint.	Labour	
	feet	m.p.h.	m.p.h.	£	£	£	£	£	pence	pence	pence	pence	pence	
Small P.T.O. £1,460 ..	10	3·7	3·13	146	52	9	10	217	29	10	1	48	46	11/2
Large P.T.O. £2,210 ..	12	3·7	3·76	221	80	13	10	324	24	9	1	48	38	10/-
Small Auto £2,780 ..	10	4·1	3·97	278	100	17	10	405	31	6	1	48	36	10/2
Medium Auto £3,890	15	4·0	5·82	389	140	23	10	562	23	5	1	48	25	8/6
Large Auto £5,200 ..	18	4·0	6·98	520	198	33	13	764	20	4	1	48	21	7/10

Table 2. Costs per Acre

Header	Small P.T.O.			Large P.T.O.			Small auto.			Medium auto.			Large auto		
Acres per annum	Over-head	Opera-ting	Total	Over-head	Opera-ting	Total	Over-head	Opera-ting	Total	Over-head	Opera-ting	Total	Over-head	Opera-ting	Total
100 ..	43/6	11/2	54/8	64/10	10/-	74/10	81/-	10/2	91/2	112/6	8/6	121/-	152/10	7/10	160/8
200 ..	21/8	11/2	32/10	42/5	10/-	52/5	40/5	10/2	50/7	56/2	8/6	64/8	76/5	7/10	84/3
300 ..	14/6	11/2	25/8	21/9	10/-	31/9	27/-	10/2	37/2	34/2	8/6	42/8	50/11	7/10	58/9
400 ..	10/10	11/2	22/-	16/3	10/-	26/3	20/3	10/2	30/5	28/1	8/6	36/7	58/2	7/10	46/-
500 ..	8/7	11/2	19/9	13/-	10/-	23/-	16/5	10/2	26/7	23/-	8/6	31/6	30/7	7/10	38/5
600 ..	7/2	11/2	18/4	10/10	10/-	20/10	13/6	10/2	23/8	18/9	8/6	27/3	25/6	7/10	33/4
700 ..	6/3	11/2	17/5	9/3	10/-	19/3	11/7	10/2	21/9	16/-	8/6	24/6	21/10	7/10	29/8
800 ..	5/5	11/2	16/7	8/1	10/-	18/1	10/1	10/2	20/3	14/-	8/6	22/6	19/1	7/10	26/11
900 ..	4/9	11/2	15/11	7/3	10/-	17/3	9/-	10/2	19/2	12/6	8/6	21/-	17/-	7/10	24/10
1,000 ..	4/5	11/2	15/7	6/6	10/-	16/6	8/1	10/2	18/3	11/3	8/6	19/9	15/3	7/10	23/1
1,100 ..				5/11	10/-	15/11	7/4	10/2	17/6	10/3	8/6	18/9	13/11	7/10	21/9
1,200 ..				5/5	10/-	15/5	6/9	10/2	16/11	9/4	8/6	17/10	12/8	7/10	20/6
1,300 ..				5/-	10/-	15/-	6/3	10/2	16/5	8/6	8/6	17/2	11/9	7/10	19/7
1,400 ..				4/7	10/-	14/7	5/10	10/2	16/-	8/-	8/6	16/6	10/11	7/10	18/9
1,500 ..				4/4	10/-	14/4	5/5	10/2	15/7	7/6	8/6	16/-	10/2	7/10	18/-
1,600 ..				4/1	10/-	14/1	5/-	10/2	15/2	7/3	8/6	15/9	9/7	7/10	17/5
1,700 ..				3/10	10/-	13/10	4/7	10/2	14/9	6/7	8/6	15/1	9/-	7/10	16/10
1,800 ..				3/7	10/-	13/7	4/5	10/2	14/7	6/3	8/6	14/9	8/6	7/10	16/4
1,900 ..				3/5	10/-	13/5	4/3	10/2	14/5	5/11	8/6	14/5	8/1	7/10	15/11
2,000 ..				3/3	10/-	13/3	4/1	10/2	14/3	5/7	8/6	14/1	7/8	7/10	15/6
2,100 ..							3/10	10/2	14/-	5/4	8/6	13/10	7/3	7/10	15/1
2,200 ..							3/8	10/2	13/10	5/1	8/6	13/7	6/11	7/10	14/9
2,300 ..							3/6	10/2	13/8	4/11	8/6	13/5	6/8	7/10	14/6
2,400 ..							3/4	10/2	13/6	4/8	8/6	13/2	6/4	7/10	14/2
2,500 ..							3/3	10/2	13/5	4/6	8/6	13/-	6/2	7/10	14/-
2,600 ..										4/4	8/6	12/10	5/10	7/10	13/8
2,700 ..										4/2	8/6	12/8	5/7	7/10	13/5
2,800 ..										4/-	8/6	12/6	5/5	7/10	13/3
2,900 ..										3/10	8/6	12/4	5/3	7/10	13/1
3,000 ..										3/9	8/6	12/3	5/1	7/10	12/11

The figures in these columns are discontinued once they have passed the maximum practical acreage—as shown in Table 3.



AVERAGE COST OF OWNING AND OPERATING HEADERS

the machine does, or whether it is used at all. These costs become less significant as they are spread over increased acreages.

Contract heading

Since it may be cheaper to employ a contractor for harvesting in some cases, the cost of contracting is also considered. The contract rate varies from 25s. to 40s. per acre in different areas. The approximate cost is 1s. per bushel or about 30s. per acre for a ten-bag crop. This cost is shown in figure 1.

Average costs

The average costs graphed in figure 1 indicate that large acreages are necessary to bring the cost of larger headers down to levels where they compete with smaller ones on a cost basis.

With a crop of less than 225 acres it is cheaper to employ a contractor, at the rate shown. On the other hand, a second-hand machine may be cheaper still for low acreages. With bigger acreages the operating costs of a second-hand machine, particularly repairs and maintenance, will probably be high. Also because of its low reliability a second-hand machine is not usually a reasonable alternative at higher acreages.

Length of harvest

Some of the advantages from larger headers and auto headers come from factors other than harvesting costs. In particular they may provide some advantage by getting the crop off more quickly. This can be vitally important, especially in summer rainfall areas. The additional income from a crop saved from summer rain may largely pay for an auto header in one year.

To indicate their adequacy in this regard we have calculated the number of days required to harvest various acreages, using the five different headers. These figures are shown in table 3.

If we assume a harvest time of about thirty days, beyond the time the weather risk is greatly increased, then it is possible to suggest a maximum acreage for which each header should be used. This is also shown in table 3.

Table 3. Working Days Taken to Harvest

Acres	Small P.T.O.	Larger P.T.O.	Small auto	Medium auto	Large auto
100 ..	3·2	2·6	2·5	1·7	1·4
200 ..	6·4	5·3	5·0	3·4	2·9
300 ..	9·6	7·9	7·6	5·2	4·3
400 ..	12·8	10·6	10·1	6·8	5·7
500 ..	16·0	13·3	12·6	8·6	7·2
600 ..	19·2	15·9	15·2	10·3	8·6
700 ..	22·4	18·6	17·7	12·0	10·0
800 ..	25·6	21·3	20·2	13·7	11·5
900 ..	28·7	23·9	22·7	15·5	12·9
1,000 ..	31·9	26·6	25·3	17·2	14·3
1,100 ..	35·1	29·3	27·8	18·9	15·7
1,200 ..		31·9	30·3	20·6	17·2
1,300 ..		34·6	32·8	22·3	18·6
1,400 ..				24·0	20·0
1,500 ..				25·8	21·5
1,600 ..				27·5	22·9
1,700 ..				29·2	24·4
1,800 ..				30·9	25·8
1,900 ..				32·6	27·2
2,000 ..					28·7
2,100 ..					30·1
2,200 ..					31·5
2,300 ..					32·9

Other considerations

Among the numerous other factors which influence decisions on the purchase of a header are the possible alternative uses for the tractor. In areas where summer crops are grown, a tractor is needed to sow these crops. This may necessitate an extra tractor if the farm tractor is used to pull the grain header. Under these circumstances an auto header will be a preferable purchase, unless extra work throughout the year justifies a second tractor.

A further advantage may be obtained from the speed and manoeuvrability of an auto header. If the header is to be used for contract work, or for work on blocks several miles apart, the time saved in road travelling can be considerable.

Many operators also see advantages in the fact that the auto header is a cleaner and more comfortable machine to operate. It is also suggested that the manoeuvrability of an auto header allows more complete coverage of the crop without overlapping areas already headed.

Finally, the capital cost of the machine involved is influenced by taxation aspects. Because machinery purchases may be written off as a cash cost over five years, together with a 20 per cent investment allowance in the first year, such a purchase may reduce income tax considerably. For a farmer with a taxable income in the 6s. to 7s. in the pound bracket the effective capital cost would be only two thirds of the purchase price. This is because for each pound paid out he would normally pay about one third of a pound in taxation. This, and the possible return from alternative uses for the money, are vital points relating to machinery purchases.

Considerations such as these make it essential that management decisions, about the purchase of a header or any other problem, be made independently for each property. The figures presented here can only be a general guide in making a decision on header purchase. ●

A Soil Test for Nitrogen?

R. R. STORRIER

OVER THE LAST DECADE subterranenean clover and the associated root nodule bacteria have increased nitrogen fertility in soils of the southern wheat belt. The resulting improvement in crops has shown the importance of nitrogen in wheat cultivation.

Crops grown after a period under clover ley have given increases in yield and grain protein and it is now possible to grow several successive profitable crops following a ley. This tendency towards intensive cropping after ley has prompted the farmer to pose the question—"Is there enough nitrogen in the soil for another crop?"

The answer requires an understanding of the occurrence and behaviour of nitrogen compounds in the soil.

The following questions and answers outline facts known about nitrogen, together with some data obtained from investigations carried out on local wheat soils.

How does nitrogen occur in the soil?

The major source of nitrogen in the soil is organic nitrogen, a complex of chemical compounds associated with the soil organic matter. A smaller proportion, about 3 to 10 per cent of the soil nitrogen occurs as inorganic or mineral nitrogen, represented by the ammonia-nitrogen and nitrate-nitrogen forms. These are the nitrogen forms found in the fertilizers sulphate of ammonia and nitrate of soda, respectively.

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Plants can use only the inorganic nitrogen, particularly the nitrate-nitrogen form.

What controls the amount of mineral nitrogen in the soil?

The level of mineral nitrogen depends upon the biological activity of the soil. The soil micro-organisms use the organic matter as food, and under suitable conditions release nitrogen as ammonia-nitrogen and nitrate-nitrogen. The process is referred to as nitrogen mineralization.

Adequate moisture and warmth are necessary for this mineralization of soil nitrogen; extremes of temperature and moisture will decrease and even prevent nitrogen mineralization.

Can management increase soil mineral nitrogen?

Farm management practices have a considerable effect on the amount of mineral nitrogen available to the plant. Correct management and regular use of superphosphate on clover leys during pasture growth will ensure a supply of readily broken down organic matter for the use of the micro-organisms during the cropping phase of a rotation. A comparison of two experimental sites in 1960 showed a level at sowing of 60 lb. of mineral nitrogen in the top 12 inches of an improved soil compared with 33 lb. in an unimproved pasture soil.

Fallowing, by controlling weed growth, increases the mineral nitrogen level in the soil. Before the advent of subterranean clover, long fallows were necessary to ensure an adequate level of mineral nitrogen.

With the introduction of a clover ley rotation a shorter fallow period may be adequate for mineral nitrogen accumulation. This aspect of farm practice is currently being investigated.

Ploughing into the soil of crop residues, such as nitrogen-poor cereal stubble, can result in the loss of mineral nitrogen. To decompose the stubble, the micro-organisms use the available mineral nitrogen, and so delay its release to the crop. The judicious burning of stubble is a preferable way of disposing of it.

When is mineral nitrogen made available to the plant?

Mineral nitrogen is made available for future plant growth during the fallow period, and the process continues during the growth of the crop.

Depending upon seasonal conditions and the fertility of the soil, mineral nitrogen levels between 15 and 130 lb. nitrogen per acre in the top 12 inches have been measured in wheat soils in the Wagga area at completion of the fallow period. On the same soils during the period of crop growth it has been conservatively calculated that an additional 20 to 80 lb. of nitrogen has been mineralized and taken up by the crop.

When does the crop absorb the soil nitrogen?

The wheat plant absorbs very little nitrogen from the soil during the four to six weeks after sowing. The plant then commences to absorb nitrogen quickly during the tillering and jointing stages, until it virtually ceases to take up any further soil nitrogen after flowering.

Wheat requires its nitrogen over only a limited period of its growth cycle. There is therefore a danger that mineral nitrogen built up by fallowing may be lost by leaching after heavy rainfall. This is particularly likely on light textured soils where the nitrate-nitrogen may be leached beyond the reach of plant roots. On the heavier textured soils, which are more common in the southern wheat belt, leaching of nitrogen occurs only after excessive rainfalls in the autumn.

From what depth is nitrogen absorbed?

Wherever plant roots have contact with soil mineral nitrogen it will generally be absorbed. Experiments have shown wheat to take up nitrogen from depths of 5 feet or more, but under local conditions the bulk of the wheat plant's requirements for nitrogen is obtained from the top 18 inches of the soil.

Can plants have too much nitrogen?

Plants can absorb excessive amounts of nitrogen, rendering themselves susceptible to disease and to moisture stress. Under wheat belt conditions an over-supply of nitrogen can result in production of excessive vegetative growth. This is very susceptible to moisture stress in the post-flowering period and may result in the crop "haying-off."

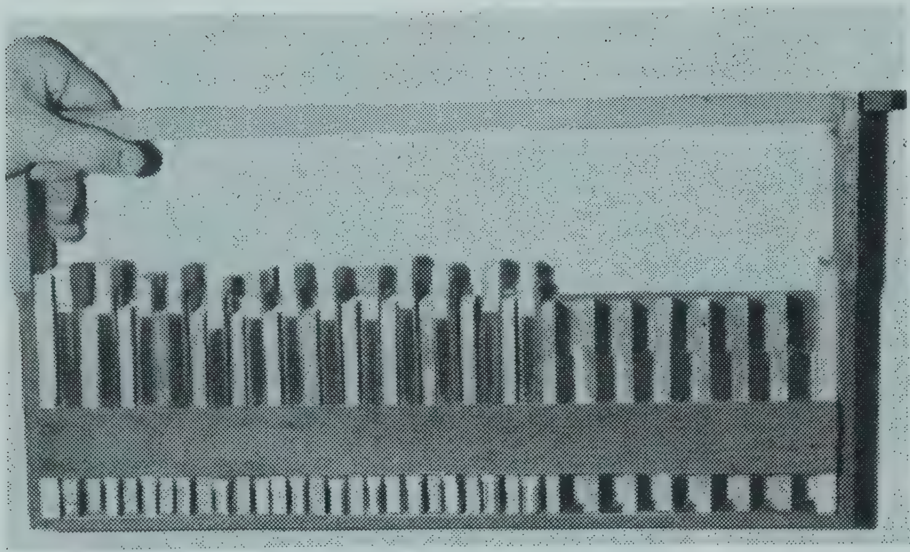
In an experiment in which the mineral nitrogen content of the soil about six weeks after sowing was increased with fertilizer from 90 lb. to 230 lb. nitrogen per acre, there was a decrease in yield, from 45 to 35 bushels per acre.

Can soil be tested for mineral nitrogen content?

It is possible to determine the amount of mineral nitrogen in the soil at the time of sampling, and by incubating a soil sample in the laboratory, under ideal conditions of moisture and temperature, obtain a measure of the nitrogen fertility of a soil.

However, attempts to use these values as a means of predicting the nitrogen requirements for crop production, or the amount of nitrogen likely to be available during the growing season, have not always met with success. This is because of the effect of climate on crop growth and on the seasonal variation in soil mineral nitrogen content.

Work on soil nitrogen at the Agricultural Research Institute is being carried out in an attempt to understand its behaviour in the soil, the factors controlling the release of mineral nitrogen for crop production, and the possibility of designing a soil test suitable for use under local wheat belt conditions. ●



A frame made to hold twenty queen introducing cages. The wooden partition between each cage is to prevent the queen bees from fighting with each other through the wire walls of the cages.

QUEEN BEE BANKS

F. S. BENECKE

A CONVENIENT METHOD of storing queen bees has been thoroughly tested in New South Wales during the past seven years.

Queen bees are caged, one to a cage, and the cages supported in a specially made frame, similar to the one illustrated above. This frame is kept in a small bee hive called a nucleus hive, or "nuc" for short. In this instance the nucleus hive has bees, brood and honey, but no queen of its own.

A hive prepared in this manner and containing a number of caged queens is called a queen bank.

The workers in the queen bank feed the queens through the wire of the cages.

More recently, queen breeders have made use of the queen bank idea but without brood, for delivery of queen bees to customers.

Queen banks offer many advantages both to beekeepers and queen breeders, the main one being that queens can be effectively stored until they are required. The queen breeder can maintain a reservoir of queens from which to meet orders, and by so doing leave the mating nucleii free for re-use.

The beekeeper can likewise keep young queens on hand ready to replace older queens. He can also make the best use of his own nucleus hives when time and conditions permit queen rearing.

Queen banks have other advantages:

- Queens in transit are kept at the correct temperature and fed the correct food. Queens in individual mailing cages have only a dozen or so escorts to protect them from extremes in temperature; their food, mailing candy, is by necessity, low in moisture.
- Queens in banks may be safely held for several months if necessary. This enables introduction to be made at a time chosen by the beekeeper. This is useful both when queens are purchased and when they are reared by the beekeeper. It is not always convenient, or possible, to drop everything to introduce queens.
- Delivering queens in banks saves the queen breeder the task of catching escort, and this saving in labour helps pay for the nucleus hive in which the bank is shipped.

The Author: *Mr. F. S. Benecke, Livestock Officer (Apiculture), Department of Agriculture, Tamworth.*

Making up a queen bank

Assuming that queen introducing cages and a frame similar to those illustrated are used, all else that is needed is a three or four frame nucleus hive and some bees and brood.

The queen should be on her own in the cage as the bees in the hive usually kill any escort that is placed with her. Be sure that the cages are placed in the frame candy end downwards so that there is no possibility of the bees releasing a number of queens.

The cages should be spaced to ensure that the queens cannot reach each other and fight through the wire gauze of the cage.

The nucs should be fairly strong so that the temperature within the hive may be effectively controlled.

Eight days after making up the queen bank, inspect all combs of brood and destroy any queen cells which may be present.

During the summer months it may be necessary to remove combs of honey from the queen bank from time to time.

Inspect the queen bank at least every three weeks and when necessary add further combs of bees and brood. When brood is added it must be inspected again in eight days time, as mentioned previously.

Use

It seems to make no difference to the queen in the bank how often the bank is opened and closed nor how often it is moved about.

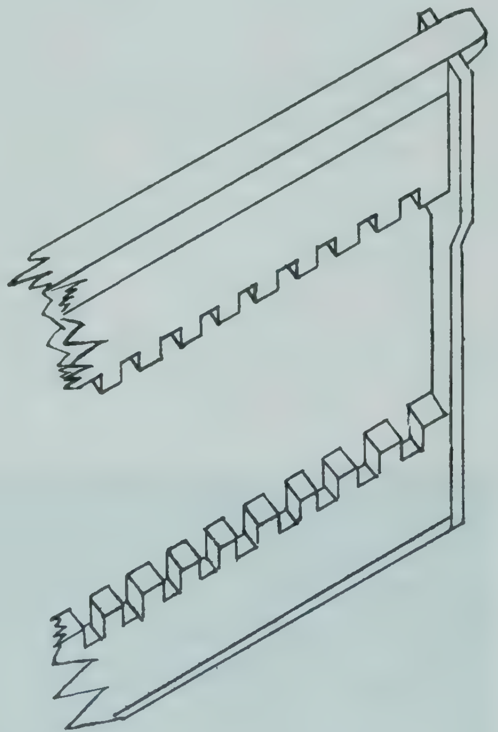
Some beekeepers put a queen bank in their truck whenever they are visiting out apiaries, so that they have queens available if they are needed.

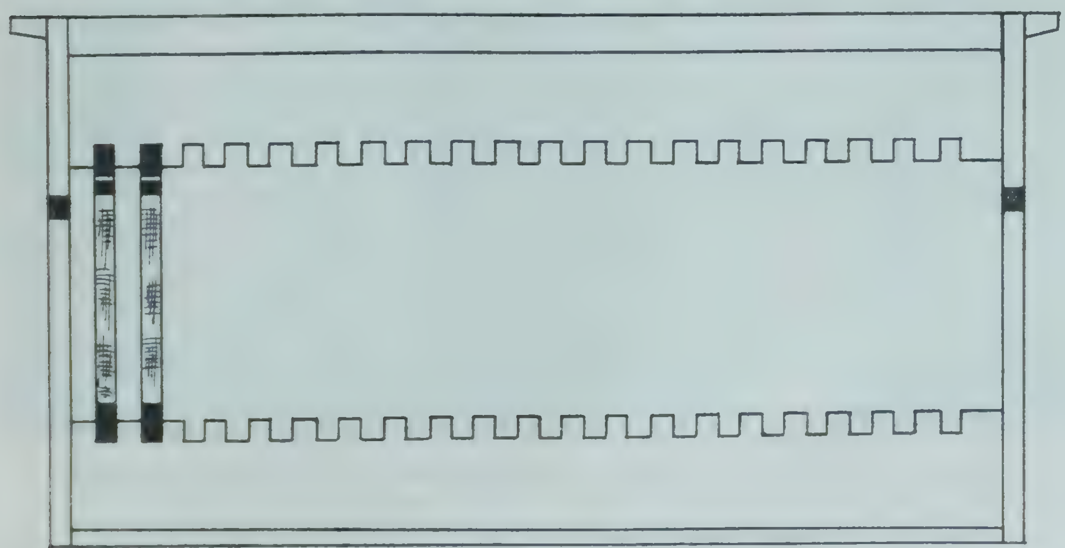
If it is proposed to hold queens in a bank for more than a week or so it is best to make a limit of about twenty queens per bank.

Queen bees are delivered from queen breeders in lots of sixty to one hundred to a bank. This number should be reduced by making up other queen banks if it is intended to store them for very long.

When storing queens in mailing cages in banks remember to keep them back to back and candy end down.

The queen bank is a useful tool to beekeepers large and small, but it is only a tool. The beekeeper himself must decide when and how to use it. ●





Frame consists of two blocks slotted to hold the ends of Miller cages. Slotted blocks are nailed into the top and bottom of the frame.

Fertilizers Lift Clover Yields in the County of Cumberland

O. G. CARTER

SUBTERRANEAN CLOVER responded to superphosphate and molybdenum in trials on three County of Cumberland soils derived from Wianamatta shale and Hawkesbury sandstone. There was a response to boron in one trial. The soils were from Badgery's Creek, Rouse Hill and Castle Hill. There was close agreement between the responses obtained in pot experiments and the responses from field trials.

Badgery's Creek soil

The Badgery's Creek soil was from the McGarvie Smith Animal Husbandry Farm. It is derived from Wianamatta shale and was described by Storrier (1951) as a non-calcic red-brown earth. The first 6 to 9

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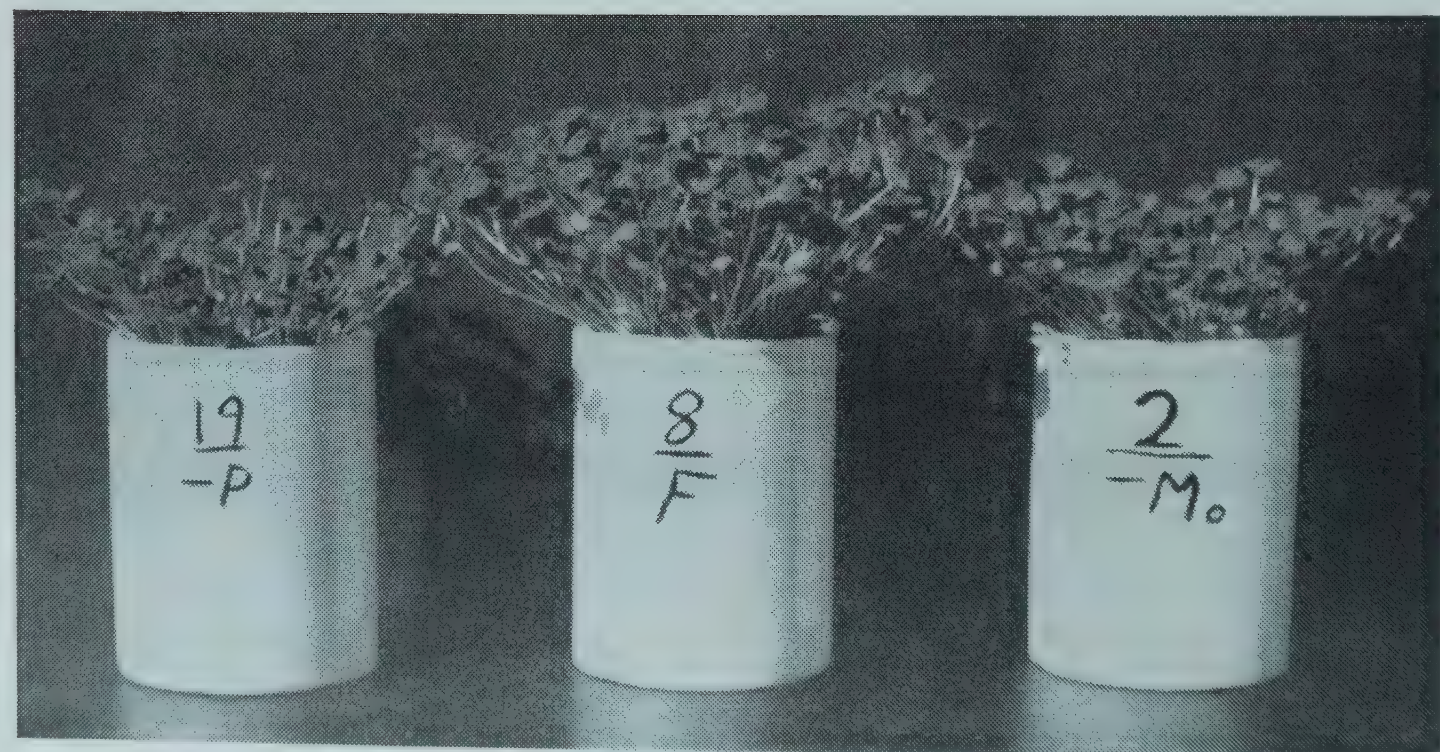


Badgery's Creek soil: there was a marked reduction in growth in the absence of phosphorus and molybdenum.

— P = no phosphorus; F = complete fertilizer; — Mo = no molybdenum.

Table 1.—Badgery's Creek Soil—clover yield as grams dry matter per pot.

Treatment	Clover yield	
All nutrients	10·3	
All nutrients except phosphorus	5·4	xx
All nutrients except molybdenum	8·1	x
Nil	5·5	xx

xx Significant P< ·001
x Significant P < ·01

inches is dark-brown clay loam overlying a red-brown mottled heavy clay. The surface pH is 5.7.

Table 1 lists the average dry weights of Mount Barker subterranean clover obtained from three replications, and the significant responses.

It would appear that molybdenised superphosphate is all that is required to give excellent growth of subterranean clover on this soil. Lime applied at a rate equivalent to one ton per acre gave no response.

Rouse Hill soil

The Rouse Hill soil was from a paddock, recently cleared of a low heath scrub, on a Mr. McMillan's farm near Rouse Hill. The soil is formed at the junction of the Wianamatta shale and Hawkesbury sandstone formations. It has a yellow-brown sandy loam topsoil over an orange-yellow B horizon showing slight clay accumulation. Surface pH is 5.0.

Results show that both phosphorus and molybdenum are severely limiting on this soil (table 2). Field results demonstrated that excellent subterranean clover can be grown with the use of molybdenised superphosphate. A response to lime was obtained only in the absence of molybdenum. Other elements failed to affect clover growth.

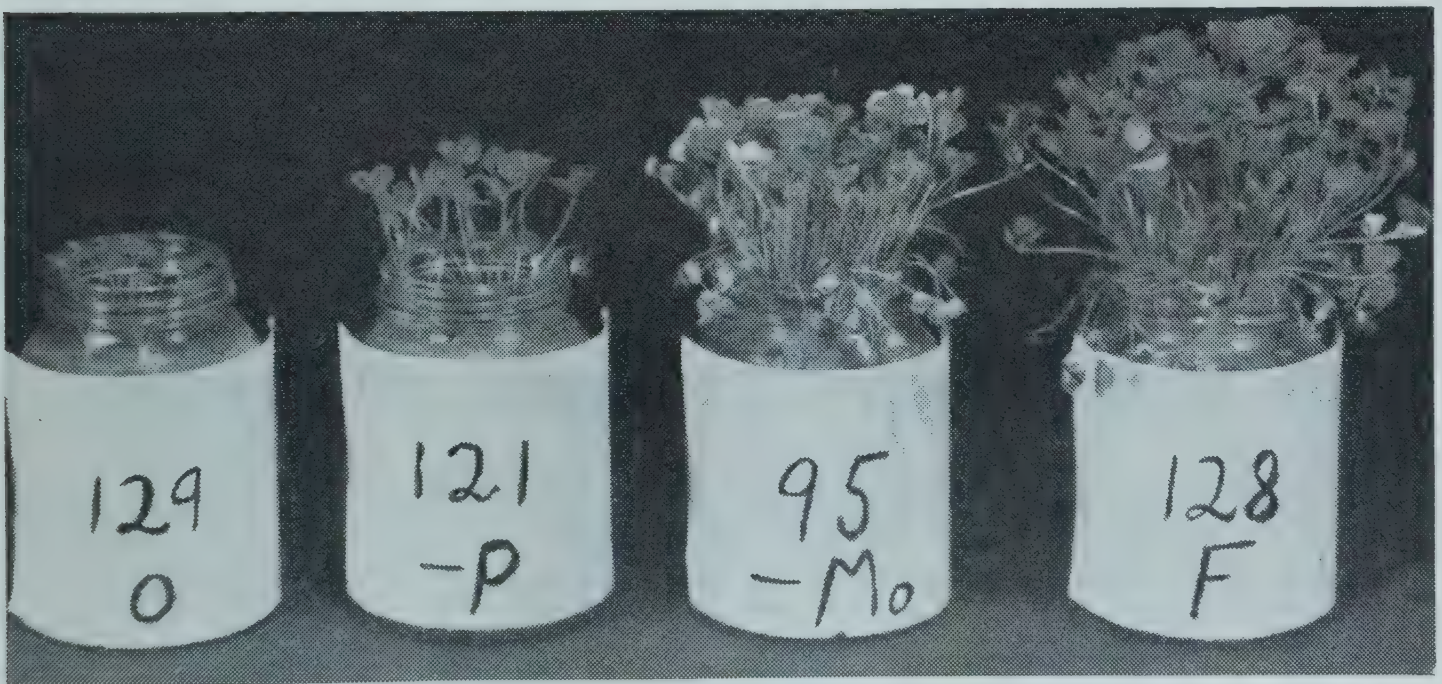
Table 2.—Rouse Hill soil—clover yield as grams dry matter per pot

Treatment	Clover yield	
All nutrients	4·2	
All nutrients except molybdenum	2·6	xx
All nutrients except phosphorus	0·4	xx
Nil	0·2	xx

xx Significant P < ·001

Castle Hill soil

The Castle Hill soil was from the Sydney University Wheat Research Farm. It is



Rouse Hill soil: Note the marked reduction in growth in the absence of phosphorus, and yellowing produced in the absence of molybdenum. The nil treatment shows the extremely poor growth obtained on this soil in the absence of phosphorus and molybdenum.

O = nil treatment; — P = all elements except phosphorus; — Mo = all elements except molybdenum; F = complete fertilizer.

a dark-grey loam at the surface with a heavy clay reddish-brown B horizon at 6 to 9 inches. Surface pH is 4.6.

Phosphorus and molybdenum greatly increased clover yields, while boron gave a smaller but important increase (table 3). On this soil, heavy liming failed to increase clover yields either in the field or in pots.

Conclusion

These trials add to the evidence of widespread phosphorus and molybdenum deficiency in the County of Cumberland. The responses to phospohrus and molybdenum are consistent with the results of J. T. Moraghan and S. G. Grimmett (1957) on Wianamatta shale soils in the County.

Provided molybdenum deficiency was corrected there was no response to heavy liming in these trials. Moraghan and Grimmett obtained responses to lime at Marsden Park and North Richmond, where lucerne was used as the test plant.

The use of molybdenised superphosphate is likely to lead to considerable increases in production on the soils tested, and boron application is desirable on the Castle Hill soil.

Table 3.—Castle Hill soil—clover yield as grams dry matter per pot

Treatment	Clover yield	
All nutrients	4·2	
All nutrients except phosphorus	0·74	xx
All nutrients except molybdenum	2·2	xx
All nutrients except boron ..	2·8	x
Nil	1·5	xx

xx Significant $P < \cdot 001$
x Significant $P < \cdot 01$

ACKNOWLEDGEMENTS

It is a pleasure to acknowledge the helpful advice and criticism of Mr. E. J. Breakwell and Mr. G. D. Sullivan. Photographs used were supplied by Mr. Woodward-Smith.

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Record Turkey Numbers in N.S.W.

R. E. COOKE-YARBOROUGH

NUMBERS OF TURKEYS on commercial holdings in New South Wales have increased each year since 1960. The 1964 total of 175,000 is the highest on record. According to Australian Turkey Federation estimates, this is a third of the Australian total.

Even so, the growth of the turkey industry in New South Wales—and Australia generally—has fallen markedly behind that in certain other countries. The accompanying chart shows that turkey numbers in New South Wales have changed little since 1951. This is in direct contrast to the two-fold increase in the United States and the three-fold increase in Canada and England and Wales.

Unstable prices and high production costs have been blamed in the past.

Improved husbandry leading to year round production, and increasing demand for turkey meat outside the traditional Christmas and Easter periods, have given a degree of price stability. However, high production costs are still a problem, and are likely to remain so for some time into the future. ●

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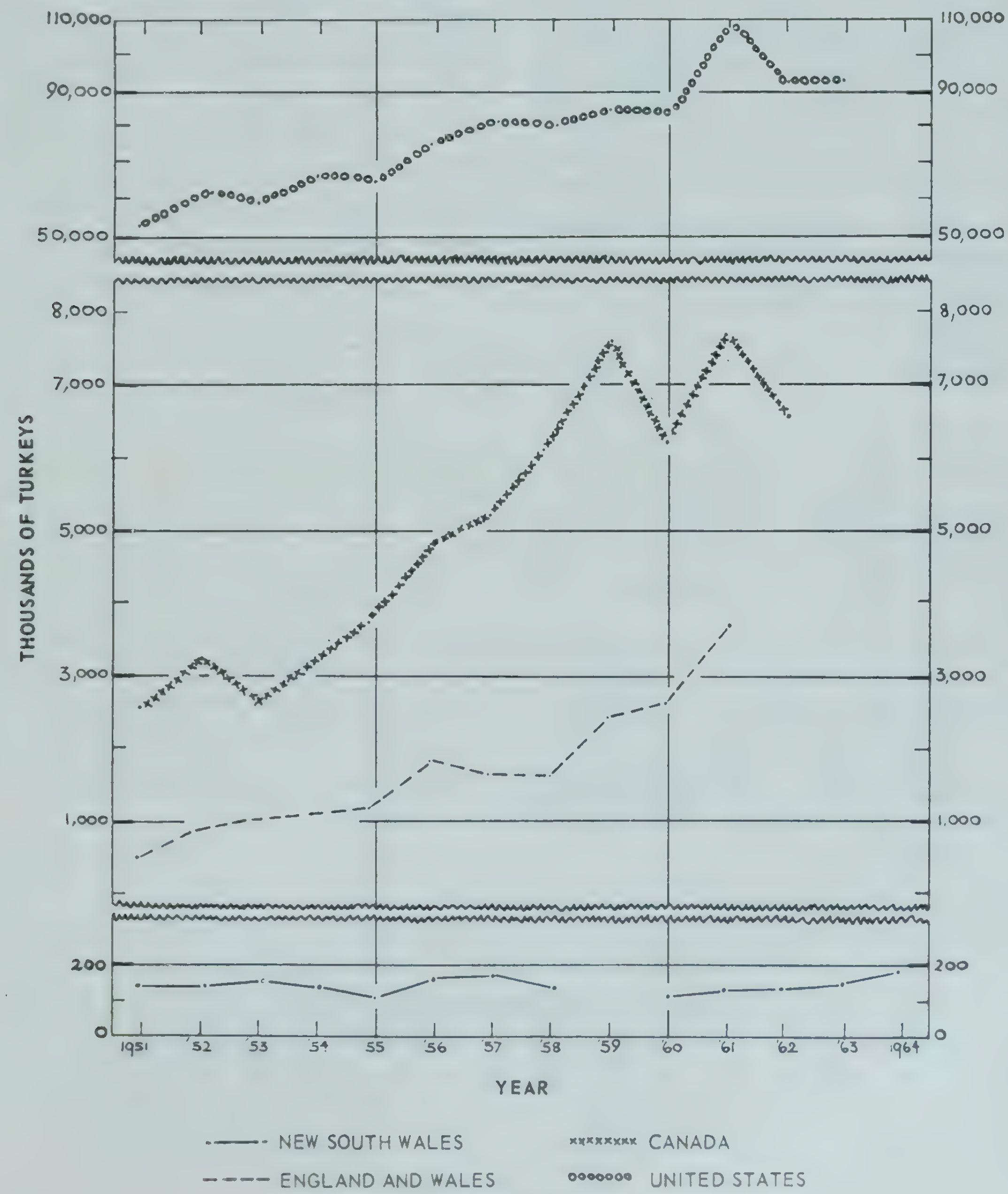

TURKEY NUMBERS SINCE 1951

BOOK REVIEW

Elements of Horseshoeing: *J. A. Springhall* (*University of Queensland Press,* 1964) 44pp., 19s. 6d.

In the post war years in Australia a remarkable interest has developed in horses, horsemanship and equitation. Literature on most aspects of these subjects has been readily available but for a long time a need has existed for a simply explained and illustrated book on horseshoeing. The British War Office book "Animal Management", with a very good chapter on horseshoeing, filled the need to some degree.

It is timely and refreshing that *Elements of Horseshoeing* has made its appearance. In the space of 44 pages the subject of horseshoeing is dealt with in a simple and absorbing manner. In seven concise chapters it deals with the structure of the hoof and adjacent parts, farriers' tools, forging the shoe, removal of the shoe, hoof preparation, fitting and nailing, shoeing of trotters, pacers and gallopers and, lastly, special shoes and their uses.

The text is supported by 16 figures which include no fewer than 51 excellent photographs. These almost tell the story in themselves for they have been carefully selected and arranged and they are of particularly high quality.

Step by step the different operations of horseshoeing, and all that goes with it, are explained in a simple but adequate manner. Even those horse owners and lovers who may never be obliged to prepare a hoof or fit or remove a shoe, could hardly read this excellent little book without becoming impressed and interested in one of nature's masterpieces, the horse's hoof.

In discussing shoes that are allowed to remain on for too long (page 6), the author refers to the "bulb of the heel" whereas the "angle of the heel" is probably the more appropriate term here. On page 8, in a discussion of the alignment of the hind limb, reference to the "point of the hip" is used in error for the "point of the buttock". On page 16 the author states that four nail holes are usually placed on the outer branch of the shoe and three on the inner branch. This, of course, is normal practice. Japanese horse shoes seen during World War II had seven tightly spaced nail holes on each branch. This could be adopted with profit in Australia and elsewhere as it permits better nailing, particularly when a hoof is faulty or damaged, by driving each nail into a sound part of the wall of the hoof.

Altogether, *"Elements of Horseshoeing"* is an excellent publication and a credit to its author. Its compilation, arrangement, quality of paper, printing and the clarity of its text leave little to be desired. It will be widely acclaimed. This little book can be unhesitatingly recommended to all who are interested in any degree in the almost lost art of horseshoeing.

W. J. B. Murphy.

RESEARCH SECTION

Inheritance of Grain Hardness in Wheat

IN INTERNATIONAL TRADE wheat is classified as hard or soft, spring or winter, and red or white in grain colour. All Australian wheats have white grain and nearly all have spring growth habit. Hardness is the only character of the three that is directly associated with quality.

There are several methods of estimating hardness, varying in complexity from examining the appearance of whole or cut grain to methods involving abrading or milling. In 1961, K. J. Symes at the Agricultural Research Institute, Wagga, established that the particle size index was a convenient method of classifying Australian wheat varieties on hardness. It is a reliable and consistent method if the effects of protein percentage and moisture content on the readings are controlled or allowed for. The particle size index has now been applied in a study of the inheritance of hardness.

Mr. Symes has demonstrated that a single gene pair is responsible for most of the difference in hardness between the varieties Heron and Falcon. A single gene was also responsible for the differences in hardness between varieties in seven other crosses, although the same gene may not be involved in all the varieties. There was evidence that other minor genes have a modifying influence. The results of the study have been published in the *Australian Journal of Agricultural Research*.

The practical implication of Mr. Symes' work is that, because hardness depends on only a single gene pair, it would be a simple matter to convert a hard wheat to a soft wheat and vice versa, by an appropriate back-crossing procedure. The particle size index test would be used to identify lines with the desired hardness. ●

Control of Emperor Mandarin Brown Spot

RESULTS of a comparison of fungicides for control of brown spot (*Alternaria citri*) on emperor mandarin have been reported by Dr. T. B. Kiely, Special Plant Pathologist. Three-year-old calamondin seedlings were used in the trial. There were five replications of three plants per plot in a randomized block design. Six treatments were compared with the control: copper oxychloride (Cuprox ®) 22 oz. per 100 gal.; bordeaux mixture 2¾-2¾-100; ziram 44 oz. per 100 gal.; N-dodecyl guanidin acetate (Melprex ®) 44 oz. per 100 gal.; thiram 44 oz. per 100 gal.; lime sulphur 2½ per cent.

The first spray application was on 27 December, 1963. At that time all calamondin plants were uniformly and severely infected with brown spot. Subsequent spray applications were on 25 January, 28 February and 8 April. At the end of May the number of twig and leaf infections on growth made after spraying started was counted. The table lists the total number of leaf infections, the total number of twig infections and the mean number of twig infections per plot.

Cover sprays appeared to be more successful in preventing infections of twigs than leaves. Thiram was superior to all the other treatments except ziram in preventing twig infection. ●

® registered trade name.

Total leaf infections, total twig infections, and the mean number of twig infections per plot.

Treatments	Total No. leaf infections	Total No. twig infections	Mean No.* twig infections per plot
Thiram	113	42	8·4
Ziram	120	69	13·8
Melprex ®	120	78	15·6
Cuprox ®	139	82	16·4
Bordeaux Mixture	125	83	16·6
Lime-sulphur	148	127	25·0
Control	192	145	29·0

* Difference for significance at P = 0·05 is 6·93. Treatments not significantly different are bracketed.
® Registered trade name.

Carbaryl Affects Tomato Plants

IN THE AUTUMN of 1964, J. G. Gellatley of the Entomology Branch made a preliminary evaluation of carbaryl against tomato pests. The test was conducted at Narara, where chemicals are screened for the control of insect and allied pests on tomatoes.

Plants were sprayed once per week from soon after planting out in February, until the end of cropping in early June. The treatments were: carbaryl w.p. 0.1 per cent + dimethoate + copper oxychloride; DDT e.c. 0.05 per cent + dimethoate + copper oxychloride; DDT w.p. 0.1 per cent + dimethoate + copper oxychloride; dimethoate + copper oxychloride; and copper oxychloride alone. Dimethoate was included in the carbaryl and DDT treatments to suppress the yellow top vector aphid, and copper oxychloride was used as a fungicide.

The DDT treatments and the carbaryl treatment gave complete control of a heavy infestation of Heliothis caterpillars. Dimethoate e.c. 0.015 per cent gave some control, but was quite inadequate.

The carbaryl-treated plants were generally reduced in vigour compared with plants in the DDT plots. They were smaller and paler, with reduced fruit size and much leaf-edge yellowing and these effects were clearly apparent after twelve spray applications. ●

Apples Stored in Polyethylene Bags

FOR MANY YEARS officers of the New South Wales Department of Agriculture and of CSIRO have co-operated on research into problems of fruit storage. The investigations were carried out at the laboratories of CSIRO Division of Food Preservation at Homebush until recent years. These laboratories are now centred at Ryde. K. Scott of the Department and E. Hall, E. Roberts and R. Wills working at CSIRO have recently reported investigations on the effects of the composition of storage atmosphere on the behaviour of apples stored in polyethylene bags (*Journal of Experimental Agriculture and Animal Husbandry*, **4** (14): 253-9.

Jonathan, Delicious and Granny Smith apples were used in studies of retention of ground colour and weight, wastage from superficial scald, and low temperature breakdown during storage. The authors found that the use of polyethylene bags greatly reduced the weight loss and maintained the fresh condition, but wastage from superficial scald and breakdown was often increased. The best retention of colour and weight and least wastage occurred in bags where the level of oxygen was low (minimum 3.6 per cent) and the level of carbon dioxide was high (maximum 6.7 per cent). Inclusion of packets of calcium chloride to reduce the humidity decreased breakdown, but further research is needed before commercial use can be made of this finding.

Other studies have shown that superficial scald can be prevented by treating the fruit with Ethoxyquin, which has recently been approved for use in New South Wales, or diphenylamine—which has not yet been approved in this country. Thus, susceptible varieties such as Granny Smith should be treated with Ethoxyquin prior to storage. Because of uncontrollable packaging factors the atmospheres which minimise breakdown cannot be obtained in every bag; consequently varieties selected for storage by this method should be restricted to fruit known to have a low susceptibility to low temperature breakdown. ●

Susceptibility Tests with Organophosphates Against *Lucilia cuprina* Wied., the Primary Blowfly of Sheep in Australia

G. J. SHANAHAN

SUMMARY

Organophosphate insecticides, currently recommended to combat blowflies of sheep in Australia, were subjected to concentration-mortality tests on the primary blowfly, Lucilia cuprina. *The data were used to determine LC 100 levels to assist in the early recognition of possible resistances to di-ethoxy and di-methoxy phosphate insecticides in field populations of blowflies.*

OVER THE PAST 10 YEARS pastoralists throughout Australia have treated their sheep with residual organic chemicals once or twice during the warmer months each year as one means to combat losses from sheep blowflies. Currently, reliance is being placed on organophosphate (OP) insecticides for the control of flystrike of sheep following the development by late 1957 of dieldrin-type resistance in *Lucilia cuprina,* the primary sheep blowfly (Shanahan 1958, Busvine & Shanahan 1961). This resistance evolved within three years of the introduction of dieldrin, and the related material aldrin, for sheep blowfly prevention and conformed to the rapid appearance of dieldrin-type resistance with other insect species exposed to field pressure from the insecticide (Ascher 1955).

About six years have elapsed since the initial widespread application of OP chemicals to sheep as alternatives to dieldrin for blowfly prevention. It is well to be prepared for possible OP resistance in field populations of *Lucilia cuprina* to diazinon, Nankor®, Nemacide and Lucijet®*. Whilst all these OP chemicals are recommended to combat sheep flystrike, diazinon is the most extensively used, but significant and increasing amounts of the other three chemicals have been employed as fly preventives in the last two years (Shanahan 1963).

The study reported in this paper was undertaken to derive base concentration-mortality data for each insecticide mentioned above on susceptible flies, for the purpose of establishing discriminating concentrations, consistently lethal to 100 per cent of susceptible flies, to facilitate recognition of any OP resistance in *Lucilia cuprina* (Hart 1960). After ascertaining discriminating concentrations for the candidate OP chemicals, the levels were then tested against large samples of susceptible and dieldrin resistant flies to ensure the validity of the diagnostic concentrations for each insecticide.

The Author: Dr. G. J. Shanahan, Entomology Branch, Department of Agriculture, Rydalmere.

*Diazinon—0, 0-di-ethyl-0-2-isopropyl - 6 - methyl - 4 - pyrimidinyl phosphorothioate.

Nankor®—0, 0-di-methyl 0-2, 4, 5-trichloro phenyl phosphorothioate.

Nemacide — 0-2, 4-dichlorophenyl 0, 0-diethyl phosphorothioate.

Lucijet®—0, 0-diethyl, 0-4 methyl mercapto 3-methyl phosphorothioate.

® registered trade name

MATERIALS AND METHODS

Fly strains

L.S.—Laboratory susceptible. No history of exposure to insecticides.

D.R.—Dieldrin resistant, a selected sub-line of a resistant colony, formed in late 1957, from larvae taken from sheep with flystrike in central western New South Wales.

Test methods

Female flies from the L.S. strain were topically treated with a series of concentrations of each insecticide. The chemicals were taken up in refined kerosene and applied, by means of a microapplicator, to the dorsal thorax of 3-to-5-days-old flies in groups of 20 females at the rate of 0.5 micro-litre per fly. The flies were held under the influence of carbon dioxide for treatment, after which they were placed in glass cylinders containing block

sugar and moistened cotton wool. Mortality records were obtained after 24 hours during which the treated flies were maintained at 26°C.

RESULTS

Results from the treatments of L.S. females with the OP chemicals previously mentioned, at a range of concentrations, are shown in the table. These data were used to prepare concentration-response lines from which the following median lethal concentration levels were obtained: diazinon 0.0057 per cent, Nankor 0.0068 per cent, Lucijet 0.0093 per cent and Nemacide 0.014 per cent.

The response data suggests that 0.02 per cent Nankor, diazinon and Lucijet and 0.03 per cent Nemacide, equivalent to 0.1 and 0.15 micrograms per female, could be expected to be lethal to susceptible flies from L.S. Approximately 1,000 females of L.S. were therefore treated with each insecticide at its discriminating concentration. Full mortality resulted in all instances. Next, about 500 females from the D.R. strain were treated with each insecticide at its discriminating concentration; once more 100 per cent mortalities were obtained.

Mortality per cent of L.S. females to OP chemicals—20 female flies per point.

Conc. per cent	Diazinon	Nankor	Lucijet	Nemacide
0·0042	10	..	..	..
0·005	45	5	..	..
0·0059	55	40	..	..
0·0071	70	50	5	..
0·0084	90	80	20	5
0·01	95	90	55	20
0·012	100	95	90	25
0·014	..	100	95	35
0·017	..	..	..	85
0·02	100	100	100	85
0·024	..	..	..	95
0·028	..	..	..	..
0·03	..	..	..	100

DISCUSSION

In general, OP resistances in insects take longer to develop than resistances to chlorinated hydrocarbon insecticides such as DDT and dieldrin. For example, some five years of field applications of OP chemicals were required to select OP resistant strains of *Musca domestica* L. (Brown 1961). The blowfly, *Chrysomyia putoria* Wied., which breeds in human excrement, is an exception in that resistances to diazinon (a di-ethoxy OP) and malathion (a di-methoxy OP), which are distinct in flies, appeared in about three years to diazinon and in about six months to malathion (Bervoets and others 1958, Busvine and others 1963).

At present, field populations of *Lucilia cuprina* are under sustained pressure from di-ethoxy (diazinon, Nemacide and Lucijet) and di-methoxy (Nankor) OP chemicals. These insecticides may be in the process of screening out OP resistant mutants. The development of dieldrin type resistance has demonstrated that the species has sufficient genetic variability to evolve field strains with resistance to at least one group of modern insecticides. The information provided in this paper, especially the establishment of OP discriminating concentrations, will greatly assist in the diagnosis of any OP resistant *Lucilia cuprina* flies during the course of surveillance tests.

Of pertinence to the current investigation, Hart (1963) provided intial evidence that *Lucilia cuprina* will not readily develop OP resistances. Selection pressure in the laboratory from diazinon, against larvae of the fly through some 50 generations, has failed to evolve di-ethoxy OP resistance. Since the selection programme was commenced with larvae, purposefully taken from sheep with flystrike from different parts of Australia to provide genetic heterogeneity, this preliminary project indicates that di-ethoxy resistant genes are not present in high frequency in natural populations of the blowfly. The close host-parasite relationship applying between the blowfly and the sheep, with the fly breeding almost exclusively on the animal and not in carcases or other decaying organic matter, nevertheless favours the accumulation of rare OP resistant individuals.

The future development of OP resistances in *Lucilia cuprina* to both di-ethoxy and di-methoxy type OP chemicals is a consideration of practical moment because suitable alternatives to OP chemicals have yet to be found. Carbamates may prove useful in this connection, but perhaps should not be introduced into the field until the question of cross resistance to OP chemicals in carbamate selected strains is more fully understood (Moorefield 1960). Alternation to unrelated chemicals, before the onset of a resistance problem with presently effective chemicals, is a serious step with an important pest such as *Lucilia cuprina*, which is distributed throughout the major sheep areas of Australia. It remains

encouraging that the blowfly used in the current tests has remained susceptible to the four OP chemicals for which response data and discriminating concentrations are provided in this paper.

ACKNOWLEDGEMENT

This work is supported by funds provided by the Commonwealth Wool Research Trust Account. Technical assistance given by Miss A. Daly is acknowledged.

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Keep Pace With the Mending

NANCY FOSKETT

WE ALL KNOW that the old saying "a stitch in time saves nine" is not just a cliche—it is true. But—how often do we heed it? Don't we end up with a pile of mending so big that it puts many of us off tackling it? "We just haven't that much time," we say, or—at the other extreme, we hastily and frantically sew on a shirt button or catch up a hem while husband or daughter stands impatiently by.

These things don't happen all the time but when they do it is worrying and irritating to us and to our family.

What can we do about it? How can we MANAGE this aspect of homemaking? Can we plan for it to happen less often?

There are one or two practical things we can do—or try to do—to ease this problem.

Where is your sewing machine? If it stands where you use it, you're way ahead and your pile of mending has a much greater chance of becoming a small one.

If you have to move the machine out of a corner, to where there's more light or more room, or—with an electric machine—nearer the power point, then the pile will grow.

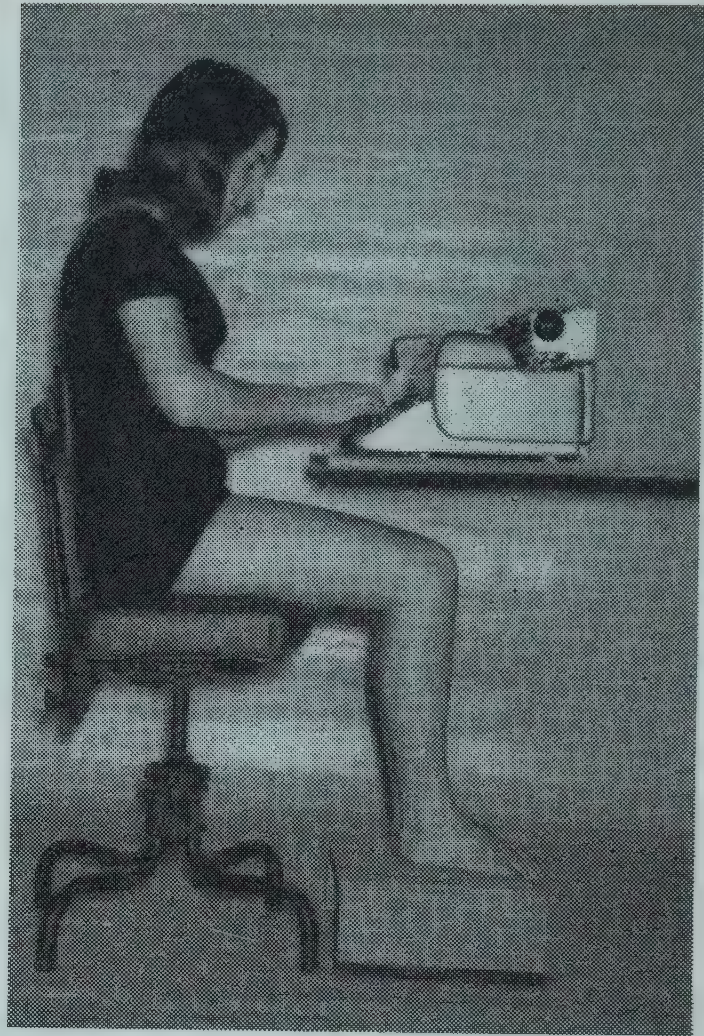
Try rearranging the furniture or buy a longer lead and keep it with the machine.

Have a sewing kit handy. Another approach is to have a sewing kit by you as you fold the linen and iron the clothes. This is when you see the break in the seam thread that will soon be a 2 inch gap; the button that will soon fall off; a catch that could become a tear if neglected.

TV. mending. The final suggestion is one that I find a help. I put all those items needing hand stitching in the one place and sew them on the evenings I watch television. This practice will help keep pace with the mending, even if you're only an occasional viewer, not an addict.

You won't see all that's on the screen, but that's not always necessary. "TV. mending" is a means of combining two activities—one of the principles of time and motion study which is a part of MANAGEMENT—of our time, our homes, and our lives. ●

The Author: Miss Nancy Foskett, Senior Extension Officer (Women's Service), Farrer Place, Sydney.



CHAIRWISE
and Otherwise

H. W. Oxford

PEOPLE have been selecting things to sit on since the dawn of history. Human beings are intended to sit. Pre-historic man and woman sat on logs and stones; cave men often cut recesses in rock, Adam Bede used a burnt-out log, the Romans made seats for two, known as "love-seats", and the famous designers of the eighteenth century brought forth a variety of chairs. Steel and aluminium have succeeded wood, and lounge chairs have been commercialised as TV. chairs.

The Author: Mr. H. W. Oxford, Chairman, Furniture Review Committee, N.S.W. Department of Education, Sydney.

Extreme left: The weight-bearing area supports 50 per cent of the sitting weight on a flat surface.

Left: Note lack of pressure on thigh tissues when using foot stool of correct height.

Below: Ideal combination—no pressure on thigh behind knee; support in lumbar region; elbow level with table; good reading distance; space behind the calf.

So history marches on. And as civilisation progresses there is a tendency for people to sit for longer periods.

More and more importance must therefore be attached to the chairs on which we sit, particularly as there is no evidence of chairs ever having been designed in the terms of anthropometry. Anthropometry is the study of measurements of the human body.

It is difficult to realise that the height of chair seats over the centuries has never been related to the size of the average woman or man. No one can justify the use of 18 in. chairs and 30 in. tables, although they have been in use for generations.

Strange as it may seem, it wasn't until World War II triggered off a series of surveys of human beings that anthropometric data strengthened the realisation of the need for correct seating. A few authorities had been drawing attention to the matter over the years, but without much effect. Now, clinical evidence of the results of sitting for long periods on high chairs has also become available.

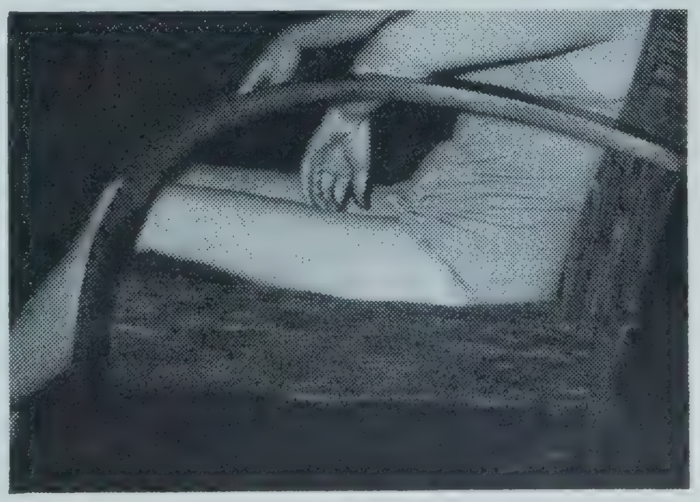
Today, it is clearly established that 18 in. chairs and 30 in. tables are too high except for tall men. They are definitely unsuitable for short men, and too high for practically every woman.

Health factors

To support the body when seated, humans have two special bones, the ischial tuberosities. Around those tuberosities are tissues capable of supporting weight.

Aeronautical researches in America have revealed that half the weight of the body is borne by only eight per cent of the total sitting area.

One-fifth of the weight is supported by the feet, provided they are resting firmly on the floor or on a footstool. If the feet are



Right: Weight-bearing area sinks into sagged seat causing pressure on thigh tissues. Note too high arm rests and pressure on calf.

Foam padding can be injurious when it increases seat height.

unsupported, this weight is transferred to the soft tissues of the thigh *which were never intended by nature to support the weight. This is an important basic principle.*

There is ample clinical evidence to show that long periods of pressure on the soft tissues of the thigh (for example when sitting on high chairs or in very soft seats) may lead to ache of the lower back, degenerative tissue changes, sciatica and poor circulation. Fatigue is certain to result. This warning has been given by the British Standards Institution in conjunction with the British Medical Research Council and British Ministry of Health.

Chairs and tables need to be properly designed for two reasons. The first is for greater comfort—which does not merely mean soft seats; and the second is to avoid fatigue and any possible factors detrimental to health.

A chair seat should not be higher than the length of the lower leg from the bare heel to the tissues behind the knees when sitting. The wearing of shoes provides an added safeguard against pressure on the thigh, particularly when the feet are moved.

Anthropometric surveys overseas have revealed that eighty per cent of adults should use chairs 17 in. high and tables 28 in. high. Generally speaking, women require chairs 16 in. high.

There is no such thing as equality of the sexes when it comes to chair sizes because women throughout the world require chairs from 1 in. to 1½ in. lower than men. It should become known to every person that harm can come from sitting on chairs which are too high, but no harm can come from sitting on chairs 2 in. too low.

Over a period of several months measurements were obtained of five hundred Sydney adults, ranging from 18 to 70 years of age. Some of the men and some of the women required chairs only 14½ in. and 13½ in. high respectively. Only 4 per cent of the women and only 40 per cent of the men needed to use 17½ in. chairs. **Ninty-six per cent of women and 60 per cent of men were using chairs which were too high.**

When the N.S.W. Department of Education carried out a survey of 12,000 pupils in 1949, it was realised that six different seat heights were required. It was also obvious that considerable variations existed between pupils of the same age; and that students 5 ft. 1 in. and 5 ft. 8 in. high could require the same size of chair.

Boys begin to have a longer lower leg measurement than girls at about third year in secondary school.

As all men and women are not the same in height, it is quite obvious that designers and manufacturers should think of the many rather than the few, particularly since no harm can come from using chairs 2 in. too low. The best all-round single heights for adults are 17 in. for chairs and 28 in. for tables.

Tables

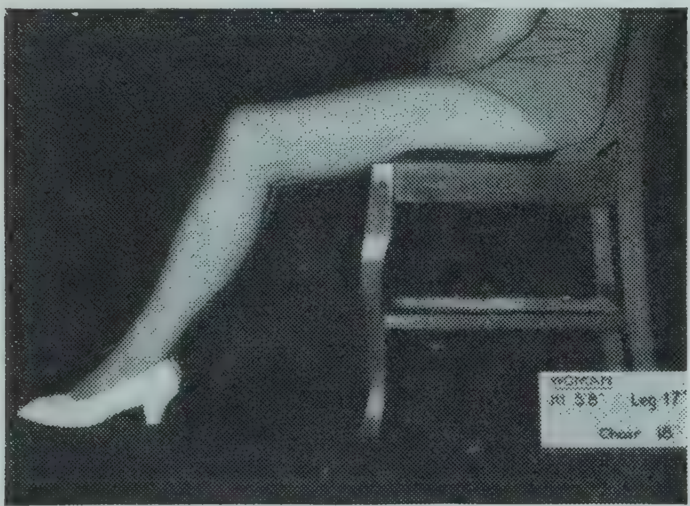
Whenever possible, the top of the table should be level with the elbow. This means that the thickness of the top and table rail must be kept to a minimum.

Low tables allow a person to get over the task. High tables, on the other hand, bring about compression of the shoulder muscles, curvature of the spine, and fatigue. High tables for children are particularly bad, as the reading distance is reduced and writing suffers.

Typists should adjust the seat so that the elbow is level with the keyboard, and then be certain that the feet are resting on something—preferably a footrest of proper height—so that no pressure is felt behind the knees. Numbness from restriction of circulation, and tingling of the nerves are the initial danger signals. Swollen legs and fatigue will result.

A few years ago, Frank and Lillian Gilbreth in *Fatigue Study* wrote "if every manager were made to sit for a certain number of hours a day with his feet hanging, there would be an enormous increase in the number of footrests to-morrow morning".

The sensible thing to do is to heed the recommendation of the expert committee of the British Standards Institution, namely, to reduce the height of the typing table to 25½ in. and for the typist to use an upholstered chair 16 in. high.



This woman is bigger than average. Despite this, the standard 18 in. chair, used in every home, is too high. Note the undesirable pressure through the thigh.

TV. chairs

Trouble is in store for people who sit on sagged or deep chairs to watch TV. for long periods. The ischial tuberosities of the body are surrounded by a small area of weight-bearing tissue. When they sink into a soft seat or cushion the weight of the body is transferred from the hard tissues to the soft tissues of the thigh so that a soft low seat can be as harmful as a high seat.

In time, this can become a serious matter. The tendency nowadays is to cover springs with too much foam. This can make the person appreciative of the initial touch down, but a soft seat makes the person uncomfortable behind the knees. Piped edges exert a pressure on blood vessels.

Some modern easy chairs are "uneasy" chairs because they are too deep. Pressure must never be felt behind the calf of the leg because, apart from health, it can become extremely irritating. A chair is too deep if it fails to provide at least 3 in. of space between the calf and the front edge of the chair. The British Medical Research Council recommends a space of 6 to 8 in. for old people. It is definitely wrong for appearance to take priority over posture and health.

It can be argued that loose cushions should be used to correct variations in depth. This is true in the case of small persons, but it is absurd to design chairs which are too deep for everyone, so that three or four loose cushions must be used to obtain any form of back support. Cushions are often too soft and unstable.

The sample of adults measured had thigh depths ranging from 14 in. to 21 in. This means that easy chairs should not exceed 16 in. for most people.

Friendly advice

If you are about to purchase utility or easy chairs for your home I strongly suggest that you purchase in terms of height and comfort and not on appearance. Avoid chairs over 17 in. high, with piped edges, and chairs which do not afford firm and obvious support in the hollow of the back.

Be sure that the easy chair is not too deep from front to back. A sloppy seat will quickly give trouble.

If, on the other hand, your existing chairs are over 17 in. high and your tables are over 30 in. high—which is almost certain—cut down an odd chair so that at least one chair in the home will afford you comfort.

Measure your lower leg without shoes, mark this distance from the top of the seat to the floor, and then proceed to saw or hacksaw the legs to uniform length by using a piece of wood as a marker.

You'll never regret it! •

Suggested Rules for Judging Ti-tree Bark Pictures

NINA MARTINDALE

TI-TREE BARK CRAFT has become a popular hobby, and many pictures are being exhibited. Some are entered at country shows.

Since I have been directly and indirectly involved with the interest in this fascinating hobby, I have been approached to evolve a set of standard rules which would resolve all differences of opinion on quality and standard of work.

The ingenuity of some hobbyists never ceases to amaze me. Unable to collect the colour varieties of ti-tree bark, they have resorted to the use of additives, for example, seaweed, dried flowers, moss, and other things for greater realism in their pictures. It does, however, create certain problems and differences of opinion in regard to what is or is not true ti-tree bark art.

It seems to me that four distinct categories must emerge as a guide for universally accepted standards in order to be absolutely fair to all varieties of this form of art work submitted for judging.

I therefore suggest the following categories or sections:

Section A, for those who use only natural and unadulterated ti-tree bark.

Section B, for those who use natural ti-tree bark with natural additives, for example, dried seaweed, moss, leaves, other bark and flowers.

Section C, for those who like to experiment with either poster, water or oil paints to touch up, or paint on, ti-tree bark.

Section D, for those who use artificial additives, such as paper cut-outs, plastic flowers and fabric pieces, together with natural or painted ti-tree bark.

All four sections should be judged according to standard rules, and 50 points is the suggested maximum.

Judging standards should include:

Balance and perspective, that is, balance of distance and background to foreground in relation to its focal point within the depicted scene.

Texture, that is, suitable use of media for depicting the scene, and its total effect in the picture.

Colour, that is, best or most attractive use of colours, whether natural or painted.

Composition, that is, arrangement of media within the picture area.

Appeal, that is, the concept of appreciated beauty created by the finished picture.

Points for judging Section A.

To include only the natural ti-tree bark.

Balance and perspective ..	10 points
Texture	10 points
Colour	10 points
Composition	10 points
Appeal	10 points
Total	50 points

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Points for judging Section B:

To include natural ti-tree bark and natural additives only.

Balance and perspective ..	10 points
Texture—	
(i) of ti-tree bark ..	5 points
(ii) of additive material	5 points
Colour	10 points
Composition	10 points
Appeal	10 points
Total	50 points

Points for judging Section C.

To include only painted or touched-up ti-tree bark.

Balance and perspective ..	10 points
Texture	5 points
Colour	15 points
Composition	10 points
Appeal	10 points
Total	50 points

Points for judging Section D.

To include natural or painted ti-tree bark together with all artificial additives.

Balance and perspective ..	10 points
Texture—	
(i) of ti-tree bark ..	5 points
(ii) of additive material	5 points
Colour—	
(i) of natural or painted ti-tree bark ..	5 points
(ii) of artificial additives	5 points
Composition—	
(i) design	5 points
(ii) suitability of additive material ..	5 points
Appeal	10 points
Total	50 points

A separate instruction leaflet on judging of ti-tree craft picture work can be obtained by writing to the Women's Service of the N.S.W. Department of Agriculture, G.P.O. Box 36, Sydney. •

TUBERCULOSIS-FREE HERDS

The following herds have been declared free of tuberculosis in accordance with the requirements of the scheme of certifying herds tubercle-free, and unless otherwise declared, this certification remains in force until the date shown in respect of each herd.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Australian Missionary College, Cooranbong (Jerseys)	123	Sept., 1965
Eeddie, R. H., Old Grenfell Road, Forbes (Shorthorns)	124	Mar., 1965
Bonnington, R. A., "Leiroy", Shorthorn Stud, "Spring Camp". Curban (Beef Shorthorns)	77	Nov., 1965
Burke, J. & M. P., "Golden Valley", Forbes Road, Cowra (Beef Shorthorns)	62	Mar., 1965
Burnside Presbyterian Orphan Homes, North Parramatta (A.I.S.)	70	July, 1965
Cochrane, R. & C. C., "Parrabel Stud", Bega (Jerseys)	160	April, 1965
De La Salle College, Castle Hill (Ayrshires)	46	July, 1966
Eather, A. D. & J., "Milgarra", Bunnan (Beef Shorthorns)	65	Sept., 1965
Elsinora Pty. Ltd., Manna Stn., Forbes ..	485	June, 1965
Everingham, C., Taree Vale Jersey Stud, Taree	122	Jan., 1965
Ewin, N., "Edenview", Greghamstown, via Blayney (A.I.S.)	60	May, 1965
Fairbairn, C. P. & C., Woomargamma Stn., Hume (Beef Shorthorns)	549	Nov., 1966
Farrer Memorial High School, Nemingha (A.I.S.)	93	May, 1964
Fleming, T. H. & Sons, "Russley", Aberdeen (Polled Shorthorns)	337	Aug., 1965
Franciscan Missionaries of Mary, Range Road, Mittagong (Friesians)	83	Mar., 1965
Freudenstein, F. J. & G. F., "Chippendale", Grenfell Road, Young (Beef Shorthorns)	89	June, 1966
Freudenstein, W. J. A. & Son, "Chippendale", Grenfell Road, Young (Beef Shorthorns)	133	June, 1966
Glen Mitchell Pastoral Co., Wellington (Poll Shorthorns)	170	April, 1966
Grafton Experiment Farm, Grafton (A.I.S., Angus)	436	Aug., 1965
Greaves, J. A., "Baroona", R.M.B. 63, West Wyalong (Beef Shorthorns) ..	44	Nov., 1965
Grey, T. J., Estate, "The Meadows", Albion Park (Jerseys)	147	Sept., 1966
Hawkesbury Agricultural College, Richmond	247	June, 1965
Hill, R. H. and Sons, Bulliac (A.I.S., Jerseys)	71	Oct., 1964
Hurlstone Agricultural High School, Glenfield (Ayrshires)	67	Aug., 1965
Limond Bros., Morisset (Ayrshires) ..	99	Aug., 1965
McSweeney, W. J., "The Rivers", Canowindra (Polled Shorthorns) ..	83	May, 1965
Maloney, D., "Heathvale", Broadwater (Jerseys)	46	Sept., 1966
Markham, J. & E., "Mara", Branxton (Jerseys)	57	Aug., 1965
Mullee Stud Farms Pty. Ltd., "Nairobi", Scone (Poll Herefords)	123	May, 1966
Mutton, J. T. & Sons., Bolwarra Maitland (Jerseys)	100	Feb., 1965
O'Dea, C., "Sunnyside", Nepean Stud, Nth. Richmond (Friesians)	109	Mar., 1966
Peel River Land and Mineral Co., "Goonoo Goonoo", Tamworth (Polled Shorthorns)	412	Oct., 1966
Pratt, H. F., "Field View", Reserve Creek via Murwillumbah	127	Nov., 1966
Reid, D. B., "Evendale", Sutton Forest (Angus)	179	Dec., 1966
Reid, G. T., "Narrengullen", Yass (Angus)	540	June, 1965
St. Vincent's Boys' Home, Westmead (A.I.S.)	16	June, 1965
Scobie, C. & Son, Abingdon Jersey Stud, Lorn, Maitland	186	Sept., 1965
Simpson, F. S., "Gunnawarra", Gulargambone (Beef Shorthorns)	238	Aug., 1965
Registered Stud Herds—*continued*		
Simson, J. N., "Nowley", Spring Ridge (Shorthorns)	227	Feb., 1966
The Scots School, Bathurst (Friesians) ..	31	Nov., 1965
Training Farm for Boys, Berry (A.I.S.) ..	122	Jan., 1966
Trangie Agricultural Research Station, Trangie (Angus)	175	May, 1966
Vitnell, A., Dalwood (A.I.S.)	115	Feb., 1965
Wagga Wagga Agricultural College (Jerseys, Poll Shorthorn)	167	May 1965
Walsh, Mrs. H. R., "Water View", Cowra (Beef Shorthorns)	120	Mar., 1965
Waters, G., "Willow Dell" Jersey Stud, "Boongala", Deniliquin	139	Mar., 1965
White, H. F., Bald Blair, Guyra (A.A.) ..	147	June, 1965
Willis, R. N. & D. M., Westbrook, Mt. Hunter, via Camden (Ayrshire) ..	207	Nov., 1966
Wollongbar Agricultural Research Station, Wollongbar (Guernseys, A.A.) ..	145	June, 1964
Wombramurra Pty. Ltd., "Wombramurra", Nundle (Devon)	136	April, 1966
Wright, Miss I. M., "Awatea Jersey Stud", Paddy's Plains, North Dorrigo	54	Dec., 1966
Yanco Agricultural High School, Yanco (Jerseys)	119	Oct., 1964
Yanco Agricultural Research Station (Jerseys, Guernseys)	127	Dec., 1965
Herds Other than Registered Stud Herds		
Adams, B. & L., "Garryowen", Wallamore Rd., Tamworth	59	Nov., 1965
Adastra Dairies Pty. Ltd., Terrace Rd., North Richmond	106	July, 1966
Baker, R. W., Luskintyre, Lochinvar ..	74	Oct., 1966
Barnardo's Homes, Dr., Tooloogan Vale, Scone	157	Feb., 1965
Bennett, J. F. M., "Oaklands", Pambula	90	May, 1965
Bethsam Holiness Mission, Wyee ..	17	Feb., 1967
Bladwell, W. R., "Loloma", Goulburn	128	Dec., 1965
Bowen, A. H., Stroud	73	April, 1966
Bridge & Bowden, Mill Creek, Stroud Road	47	April, 1965
Brookfield Afforestation Camp, Mannus	268	May, 1965
Brown, R., Valery	58	Aug., 1965
Charlton, R. J., Caniba Street, Lismore	66	Dec., 1965
Chesham, C. H., Picton Road, The Oaks	45	April, 1965
Child Welfare Dept., "Werrington Park", St. Marys (A.I.S.)	34	Feb., 1965
Coilsfield Pty. Ltd., "Coilsfield", Orange	244	Dec., 1965
Cole, E. J. & Sons, Lochiel	127	April, 1966
Cole, G., South Pambula	53	Oct., 1965
C. V. and H. G. Denton, "Yarrawood Farm", Merimbula	91	May, 1965
Croagh Patrick Orphanage, Park St. Orange	61	Feb., 1965
Duck Creek Farm, Wollongbar ..	118	June, 1964
Dunshire, J. S., "Glenara", Riverview Rd., Lansvale	164	May, 1965
Ellensville Est., "Ellensville", Glenmore, via Camden	154	Dec., 1966
Ellwood, H., Attwater Avenue, Cessnock	61	Mar., 1966
Enright, M. (Mrs.), "Hinton Vale", Hinton	95	June, 1966
Fairbridge Farm School, Molong ..	73	Jan., 1966
Farley, D. J., Stroud	88	Dec., 1965
Foley, L. F., Lucknow, via Orange ..	29	Dec., 1965
Forster & Sons, "Abington", Bundarra	53	April, 1965
Franciscan Fathers, Maryfields, Campbelltown	50	April, 1965
Gilbert, A. E., Mill Creek, Stroud ..	117	Aug., 1966
Gorton, I. E., Stroud Road, N.S.W. ..	76	Dec., 1966
Greenham, J. R., Hill Creek, Stroud ..	45	Sept., 1965
Harrington, J. B. & J., "Mt. Erin", Campbelltown	97	Nov., 1965

Tuberculosis-free Herds—continued

Owner and Address	Number Tested	Expiry Date
Herds other than Registered Stud Herds—*continued*		
Harrington, P. P. "Glen Erin", Leumeah	69	Nov., 1965
Hawkey, H. R., "Trevone", Menangle	271	Nov., 1964
Hawkins, G. A., Freemans Reach ..	63	Mar., 1965
Her Majesty's Training Centre, Emu Plains	164	Feb., 1965
Her Majesty's Training Centre, Goulburn	31	Mar., 1965
Hill, W. S., "Questwill", Crooked Lane, North Richmond	55	July, 1966
Hill, R. H. & Sons, Bulliac	107	Oct., 1966
Johnson, J. R. & P. M., Wallamore Road, Tamworth	123	July, 1965
Kenmore Hospital, Kenmore	120	Mar., 1965
Lee, G. N., Taree	62	Nov., 1966
MacArthur Stanham Holdings Pty. Ltd., Camden Park, Menangle	275	Oct., 1965
McGrogan, J., Percy Street, Singleton ..	83	Jan., 1967
Margery, G. W., Stroud Road, Stroud ..	68	Aug., 1965
Merchant, Mrs. P., East Gresford ..	85	Dec., 1965
Moffit, C. E., Central Tilba	149	Jan., 1964
Monkittee Pastoral Co., Braidwood ..	47	Nov., 1965
Morisset Hospital, Morisset	84	Mar., 1965
Moxham Bros., "Mullengudgery", Mullengudgery	106	Dec., 1964
Mt. Penang Training School (Gosford Farm Homes), Gosford	68	May, 1965
Naroo Pastoral Co. Pty. Ltd., "Jemalong", Forbes	403	Jan., 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong	101	Sept., 1965
O'Dea, C., "Sunnyside", North Richmond	94	Mar., 1965
Odewahn, R., 113 Argyle St., Parramatta	20	Sept., 1965
North Parramatta Psychiatric Centre ..	48	Aug., 1965
Passionist Fathers, Mary's Mount, Goulburn	16	Mar., 1965
Perry, K. T., Millingandi, via Eden ..	69	July, 1965
Pitt, S. R., Wylie's Flat, via Singleton ..	44	July, 1966
Ramsey, E. J., "Manor Park", Parkes ..	100	Feb., 1964
Ryan, P., Hallsville	33	July, 1965

Owner and Address	Number Tested	Expiry Date
Herds Other than Registered Stud Herds—*continued*		
Rydalmere Hospital, Rydalmere ..	28	Nov., 1965
Scott, S., Mullumbimby	71	Sept., 1966
Sheildrake Bros., "Clearview", Box 11, Picton	93	Nov., 1966
Simpson, A. T., "Kenso", Forest Road, Orange	191	April, 1966
Stinson, J. B., Church Lane, Castlereagh	88	Oct., 1966
St. John of God Training Centre, Morisset	22	Sept., 1965
St. John's Orphanage, Goulburn	9	Mar., 1965
St. Joseph's Orphanage, Cowper	70	Nov., 1964
St. Joseph's Orphanage, "Kenmore", Goulburn	5	Mar., 1965
St. Joseph's Orphanage, Kincumber ..	39	April, 1966
Sternbeck, C. H., Laguna House, Laguna	109	April, 1965
Sydney Church of England Grammar School, Moss Vale (Jerseys)	210	Nov., 1966
Taylor Bros., Tathra Road, Bega ..	145	Nov., 1965
Tegel, A. A. Pty. Ltd., Heath Road, Leppington	92	Nov., 1966
Thompson, L. K., "Redbourneberry", Singleton	85	Mar., 1965
Turner, R. G., "Merriwinga", Tilba Tilba	67	Sept., 1964
Training School for Boys, Mittagong ..	91	Feb., 1966
United Protestant Association, "Sunny Lands", Wollongbar	39	Nov., 1965
Whelan, W. G., Kiah, via Eden	62	Nov., 1966
Whelan, W. R., Bulahdelah	56	April, 1966
Wiley, F. J., Candelo	12	June, 1965
William Thompson Masonic School, Baulkham Hills	66	Sept., 1965
Williamson, R. J., Fattorini Island, Gladestone, N.S.W.	55	April, 1966
Wilson, A. J., Nicholls Street, Stroud ..	57	Nov., 1965
Wilson, K., Woodlawn, via Lismore ..	51	Sept., 1966
Wood, Mrs. J., Redbourneberry, Singleton	16	Sept., 1966
Youth Welfare Association of Australia, Hopegood, Bowral	241	Dec., 1966

R. M. WATTS, Chief, Division of Animal Industry.

Brucellosis-free Herds (Cattle)

The following herds have been declared free of brucellosis in accordance with the requirements of the scheme of certifying herds brucellosis-free.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Burke, J. and M. P., "Golden Valley", Cowra (Beef Shorthorn)	58	April, 1965
De La Salle College, Oakhill, Castle Hill (Ayrshire)	46	July, 1965
Hurlstone Agricultural High School, Glenfield (Ayrshire)	67	Aug., 1965
McSweeney, W. J., "The Rivers", Canowindra (Poll Shorthorns)	83	May, 1965
"Wombramurra", Pty. Ltd., Nundle (Devon)	135	May 1965

Owner and Address	Number Tested	Expiry Date
Herds Other than Registered Stud Herds		
Fairbridge Farm School, Molong ..	73	Feb., 1966
Forster & Sons, "Abington", Bundarra	53	Mar., 1965
Mt. Penang Training School, Gosford ..	62	June, 1965
St. John of God Training Centre, Morisset	21	Feb., 1965
Training School for Boys, Mittagong ..	98	Feb., 1965

R. M. WATTS, Chief, Division of Animal Industry.

Brucellosis-free Herds (Swine)

The following is a list of names and addresses of owners of herds which have been declared brucellosis-free in accordance with the requirements of the Brucellosis-free Herd Scheme (Swine).

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Boyle, W. R., Alford Point Road, Menai (Tamworth and Berkshire)	15	June, 1965
Campbell, D. C., "Hillangrove Stud", Wamberal (Large White)	14	Feb., 1965
Carter, P. L., Woorak Stud, Pine Ridge, via Quirindi (Tamworth & Large White)	37	July, 1965
Draper, R. E., "Glengar", Capertee (Tamworth)	6	Nov., 1965
Farrer Memorial Agricultural High School, Nemingha (Berkshire)	9	April, 1965
Grafton Experiment Farm, Grafton (Berkshire)	15	April, 1965
Hawkesbury Agricultural College, Richmond	55	Mar., 1965
Hurlstone Agricultural High School, Glenfield (Berkshire)	7	Sept., 1965
Registered Stud Herds—*continued*		
Lambeth, A. J., "Talanga", Douglas Park (Berkshire)	11	May, 1965
Maxwell, J. D. "Brooklyn", Barmedman	10	July, 1965
Mt. Penang Training School, Gosford (Berkshire)	10	June, 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong (Berkshire)	7	Aug., 1965
Wagga Agricultural College (Berkshire, Tamworth and Large White)	22	Sept., 1965
Wollongbar Agricultural Research Station, Wollongbar (Tamworth)	29	July, 1965
Yanco Agricultural High School, Yanco (Berkshire)	19	Sept., 1965
Herds Other than Registered Stud Herds		
Brookfield Afforestation Camp, Mannus	14	April, 1965

R. M. WATTS, Chief, Division of Animal Industry.

Areas Undergoing Regular Testing for Tuberculosis

Quarantine Areas (Tuberculosis)—Urban Areas

The following areas have been declared quarantine areas to ensure that a tubercle-free milk supply is available to residents. No cattle from which milk or milk products are obtained for human consumption are allowed to be kept therein unless subjected to the tuberculin test and found free from tuberculosis:

Barraba	Coonabarabran	Griffith	Muswellbrook
Bingara	Coonamble	Inverell	Parkes
Braidwood	Crookwell	Junee	Queanbeyan
Casino	Glen Innes	Kempsey	Walgett
Condobolin	Grenfell	Moree	

Quarantine Areas (Tuberculosis)—Eradication Areas

The following areas have been declared quarantine areas for the purpose of eradicating tuberculosis from cattle contained therein. All owners are required to have all their cattle tested for tuberculosis when notice for testing is served:

Bellingen	Dorrigo	Manning	Tintenbar
Bodalla	Dungog	Milton	Tyalgum
Brushy Hill	Dyraaba	Moss Vale	Ulmarra
Burringbar	East Casino	Mullumbimby	Upper Richmond
Caniaba	East Kempsey	Myrtle	Upper Wollomba
Cessnock	Fawcetts	Nimbin	Warkworth
Chichester	Illawarra	Nth. Tweed	West Kempsey
Clybucca	Kyogle	Salisbury	Wingham
Comboyne	Lavadia	Singleton	Woodburn
Coraki	Lawrence	Southgate	Woodford Island
Cumberland	Lower Hunter	South Lismore	
Denman	Maitland	Stewart's River	

Tuberculosis Protected Area

The following areas have been declared tubercle free and no cattle are allowed to be kept therein unless subjected to the tuberculin test and found free from tuberculosis.

Bombala	Broken Hill	Gulgong
Bredbo	Cooma	Warialda

R. M. WATTS, Chief, Division of Animal Industry.

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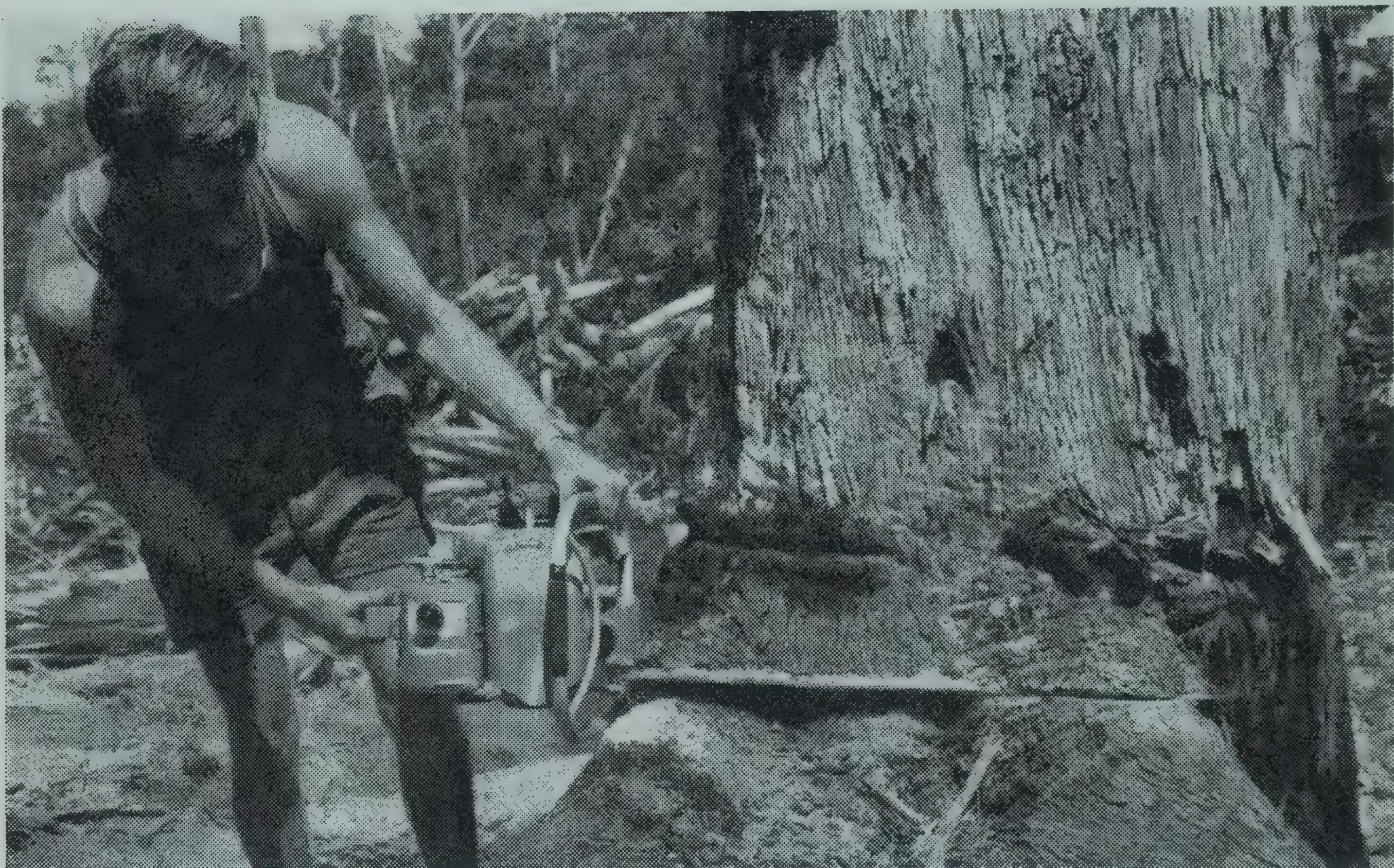
SELECTING A CHAIN SAW

CHAIN SAWS have become very popular in New South Wales. They are used for felling trees, clearing land, cutting firewood, lopping trees, pruning, cutting silage,



Making a horizontal cut. The engine must function at all angles.

sawing planks into required lengths, and making fence posts and rails. They have largely replaced hand tools for these purposes.

Their popularity has been brought about because they handle this work cleanly, efficiently and very quickly, and they impose less strain on the operator.

Features

The basic design of chain saws demands that they be made of strong, light material, and preferably that can be welded.

Engines used on most chain saws are mass produced. They have been developed and tested for use in chain saws for many years in the forests of Europe and North America. Most farm-type chain saws are powered with 2-stroke, air-cooled engines.

J. G. J. DREVER

Crankshafts are preferably made of alloy steel. They are single throw crankshafts, precision ground and are usually mounted on hardened roller or ball bearings. Con-

Balance, lack of vibration, and lightness in a chain saw are important.

necting rods are usually made from alloy steel forgings and are fitted with caged needle roller bearings. Bronze bearings are sometimes used on the cheaper models. Ball or roller or needle roller bearings are to be preferred.

It is important when purchasing a chain saw to see that the magneto is well sealed against dust and moisture. Some manufacturers also fit a moisture-proof ignition switch. These features make engines more reliable, particularly when starting.

Carburettors should be fully protected and of a type that will function at all the angles that you want the saw to work at. A widely used carburettor is the diaphragm type. Carburettors on some cheaper and

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The Author: Mr. J. G. J. Drever, Agricultural Engineer, Farrer Place, Sydney.

old models will not function efficiently at all angles.

Most farm-type chain saws have an anti-kick recoil starter.

When purchasing, check to make sure that the air filter is well protected against dust and chips. An air filter with a large surface area is an advantage. Some manufacturers supply general purpose filters as standard equipment and special filters for dry dusty conditions.

A large exhaust muffler has advantages, for it can reduce the noise without impairing the efficiency of the machine. Some companies fit special mufflers to reduce the characteristic sharp exhaust noise made by chain saw engines. A low velocity exhaust is advantageous. The exhaust system should also cool the exhaust gases and deflect them away from the operator.

Most manufacturers supply spark arrestors which should always be used during the Bush Fire Danger Period, and at other times when there is a risk of fire.

Most clutches on chain saws are completely automatic in operation, self energising and self adjusting.

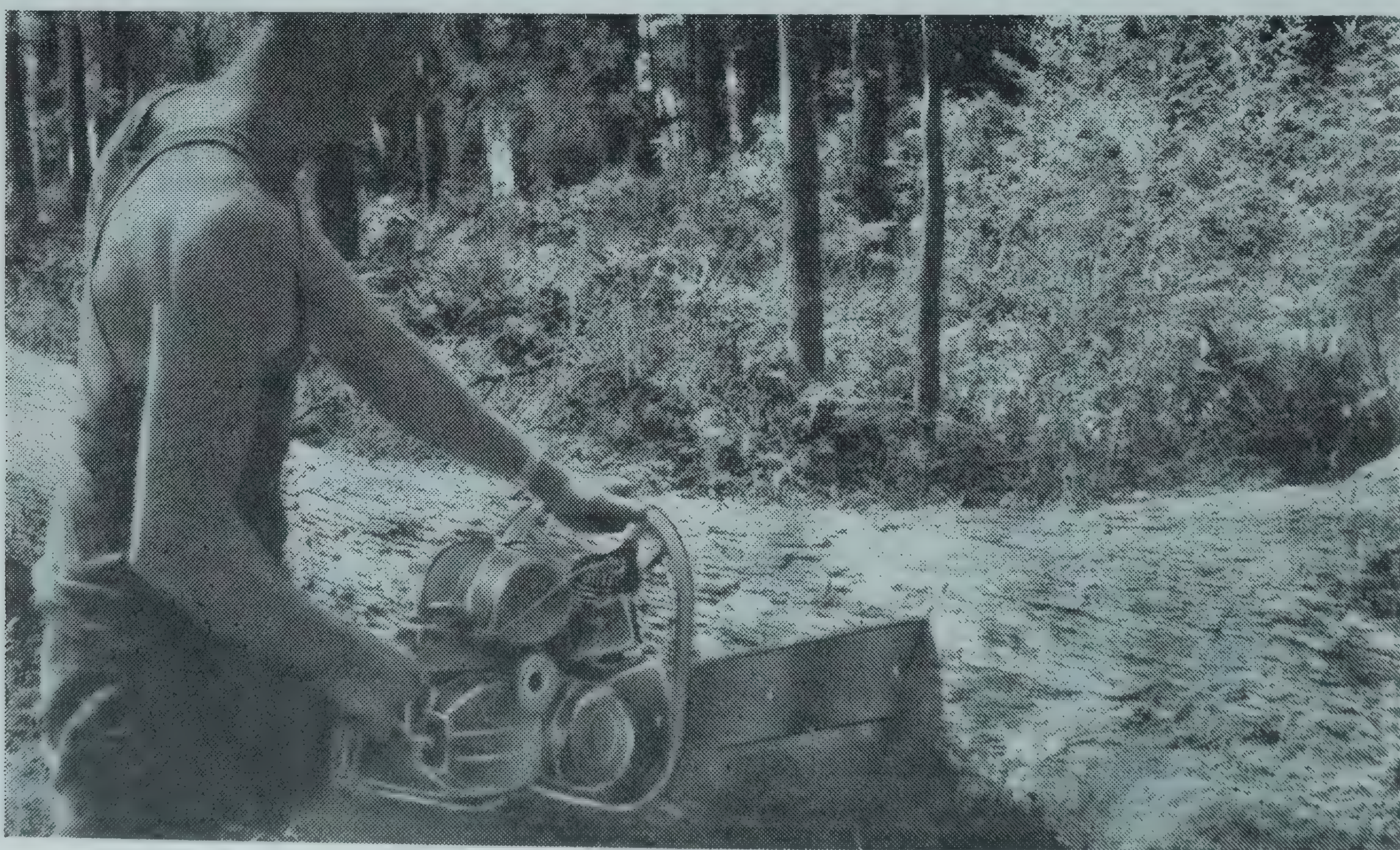
A protective governor protects the engine from "over-revving".

Cooling is important. The cooling fins attached to the cylinder should have as large an area as possible; their job is to transfer the tremendous heat from the combustion chamber to the outside air. Some manufacturers go to the trouble of fitting high velocity blowers to reduce the temperature of the motor.

The controls, which include starter, oiler and choke ignition switch, should be easy to use. They should be where you can readily get to them. Single handed operation of the controls at all angles of operation is desirable.

Fuel tanks are of various types. Polythene is sometimes used, but it should be completely encased in light metal to prevent it getting damaged. They have varying capacities, but are usually about one quart.

Guide bars are usually made of alloy steel specially heat treated and many are stellite tipped for greater strength. Bars are available in sizes from 15 in. to 42 in. Popular farm sizes are 17 in and 21 in. The cut is always a few inches less than the bar



Chain saws are used for all manner of heavy timber cutting. Also, attachments are available for such jobs as pruning, and fence post boring.

size. Some companies supply needle roller bearing noses instead of stellite noses. These are designed to eliminate friction and reduce heat.

Sprockets are usually made from case hardened nickel alloy steel.

Sprockets wear out very rapidly after they have worn through the case hardened surface of the teeth. Some companies supply sprockets with more teeth than the standard part specially for cutting smaller timber.

Engine ratings

There is no standardisation in the rating of engines in chain saws, and consequently horsepower comparisons between manufacturers must be treated with reserve. The size of an engine is not always a true guide to its power output, since a well designed small engine may have an output quite out of proportion to its cubic capacity. In most cases manufacturers have designed their saws to suit the power of their engines. Some of the very cheap saws have engines which cannot be run continuously and whose guaranteed life is very much less than the higher quality models.

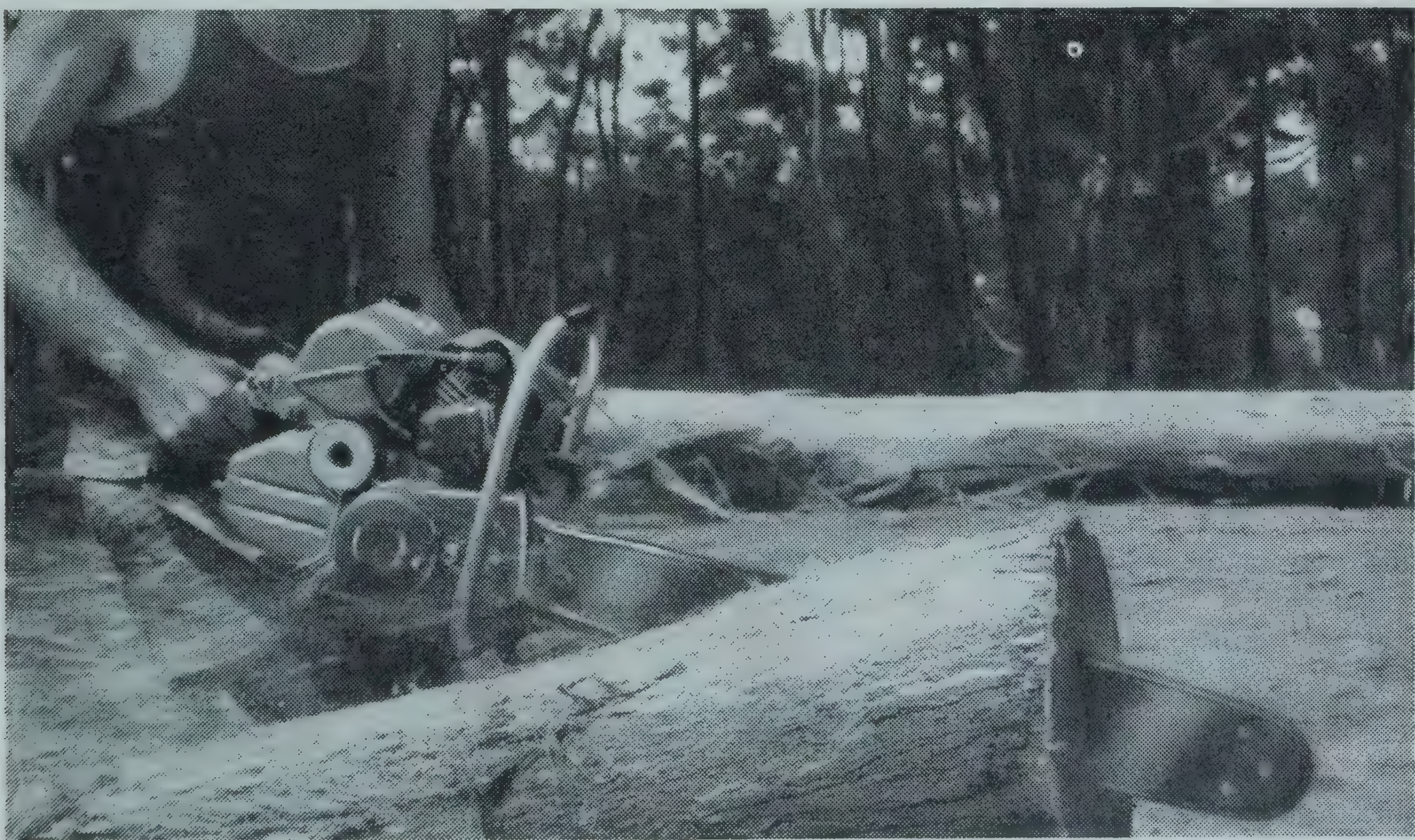
Chain oiling systems on many saws are of the push button or diaphragm type which enable the operator to vary lubrication according to conditions. Some models have entirely automatic lubrication, others have automatic oiling with a thumb booster.

Noise is a major criticism of all chain saws. To reduce noise a heavy silencer would have to be fitted and this would add to the weight of the saw.

To most landholders the lightness of a saw is probably more important than the noise it makes, especially if the chain saw has to be carried around for many hours of the day.

The way a saw balances is of great importance. A well balanced saw makes the saw easier to work with and carry. It should balance when held by the handle. The way a chain saw balances depends on a number of factors, the principal one being the length of cutter bar fitted.

Generally speaking, when a saw is available with two lengths of cutter bars, it is best whenever possible to use it with the shorter length, as it balances better with this.



Certain parts of the motor, such as the magneto and the air filter, must be well protected against dust. Spark arrestors, also, should be used at appropriate times.

Some saws vibrate slightly more than others. When choosing a saw choose one which will not shake too much. Always check this point before taking delivery. Vibration shows up on a short trial. A saw which vibrates too much will require continual tightening up and more maintenance.

A saw should have fool-proof guards. When choosing a saw have a good look at this feature. Always check the rigidity of the guards and whether they can be easily and quickly taken off when it is necessary to service the air filter and carburettor. A sawdust guard is a safety feature. It should eject all chips and sawdust away from the operator and air filter.

Simplicity and cleanliness of construction are desirable features. Remember that corners provide lodging places for dirt.

Scratch versus chipper chains

Two types of gauge chains have been developed for chain saws, the scratch and the chipper types.

The type of chain saw most widely used by Australian landholders is known as the chipper chain. The advantage of the chipper chain lies in the fact that it is quickly and easily sharpened, having only about one quarter the number of teeth of the equivalent scratch chain. Mr. H. F. Heath pointed out in the C.S.I.R.O. Forest Products Newsletter No. 256, September, 1959 that test results have shown that a properly sharpened chipper chain cuts at least as well as the scratch chain. Very few scratch type saws are now sold.

Geared versus direct drive saws

On the modern gear saw the sprocket is mounted on a shaft which is driven from the crankshaft through a centrifugal clutch and a train of reduction gears. The chain speed varies, but is usually about 1,200 feet per minute.

On the direct drive saw the sprocket is mounted directly on the crankshaft assembly, and is driven through a centrifugal clutch at engine speed. The chain speed is usually about 3,000 feet per minute. It is very much faster than the gear saw.

Direct drive saws are usually substantially cheaper. They are lighter and easier to operate than geared saws, as they do not employ a gearbox. Research work done by Mr. H. F. Heath of C.S.I.R.O. Forest Products Division indicates that there is less operator fatigue with direct drive saws, this increases work output and there is less danger of accidents. The high chain speed makes the saw practically self feeding and less effort is required by the operator. The direct drive saw does not suffer the same degree from "kick-back" as a gear drive saw when commencing a boring cut or when the chain suddenly becomes pinched, so it is generally a safer saw to use.

The higher speeds of direct drive saws, however, give rise to greater wear in chains, bars and sprockets, therefore they tend to have higher maintenance costs than gear drive saws.

The chains on direct drive saws also require more accurate and more frequent sharpening and more careful maintenance than chains on geared saws.

Direct drive units with their fast self-feeding chains are best in soft timbers, light timbers and green hard timbers.

Gear drive machines with their slower speeds are better suited for hard, dense, dry, knotty and gritty timbers.

Selection

When buying a chain saw some of the principal considerations should be:

Are spare parts readily available in your country town?

Does the engine start easily?

Does the saw balance, and do the handling characteristics suit you?

Is the oiling system satisfactory? Automatic chain oiling is an advantage, especially when an additional hand pump is also fitted.

What size blade do you need? Fit as short a blade as you can manage with. Long blades are heavier, and can give rise to handling and balance difficulties; they also can give more lubrication troubles.

Will your dealer give you chain sharpening instruction?

Is there a sensible tool kit with the saw?

Try and assess against comparative prices such things as engine horsepower, depth of cut, weight of complete saw, rate of cutting. The rate of cutting can often be assessed at a field day.

As a guide to purchasing, a specification table of the type shown is useful.

Useful attachments can be obtained to fit certain chain saws. These include:

Earth augers for making holes of diameters 6 in. and 9 in.

Scrub cutting attachments. These consist of a shaft 6 feet long having an angled geared head to which is fitted a 10 in. circular saw blade. The saw is suitably guarded and can also be used for pruning.

Weed cutter attachments are similar to scrub cutters but the saw blade is replaced by a double-ended cutter blade. This blade is also shrouded. The effective cutting width is 14 in.

Pruning attachments are basically a spiral fluted bit which rotates very fast between angular guides. The flutes are hollow ground and shave away the timber fibres. Extension poles are available up to 12 ft. long.

Fence post boring attachments consist of a length of flexible shaft which can be driven forward, backwards or remain in neutral. The drive head has two chucks, one runs at 350 r.p.m. and handles up to $1\frac{1}{4}$ in. machine auger bits and the other runs at 1,100 r.p.m. for high speed boring of droppers.

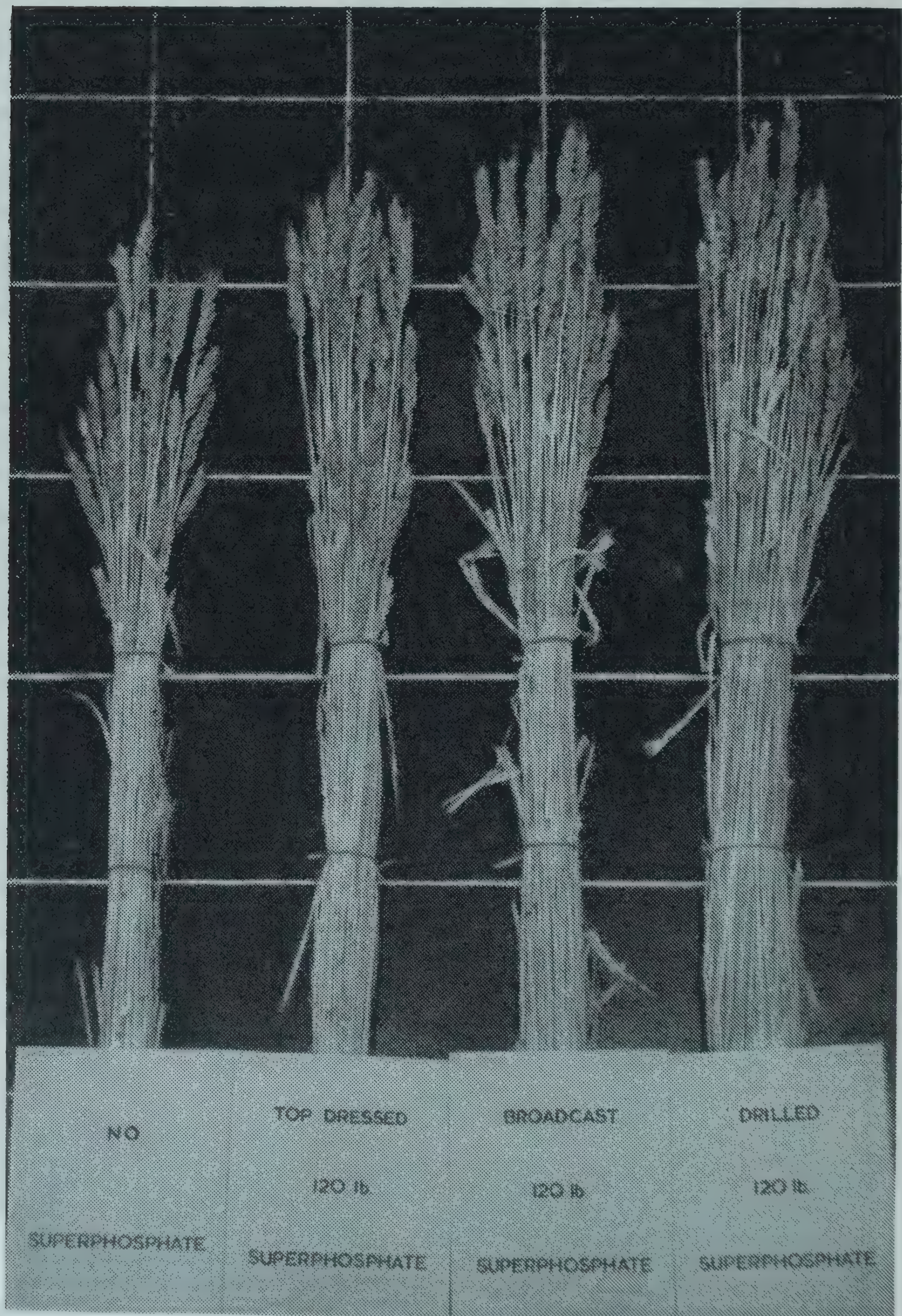
Specifications	Model A	Model B	Model C
H.P.			
Bore			
Stroke			
Capacity (cubic inches)			
Carburettor type ..			
Chain speed under load..			
Cutter bar size ..			
Drive—gear or direct			
Oiling system.. ..			
Price			

Price of saws

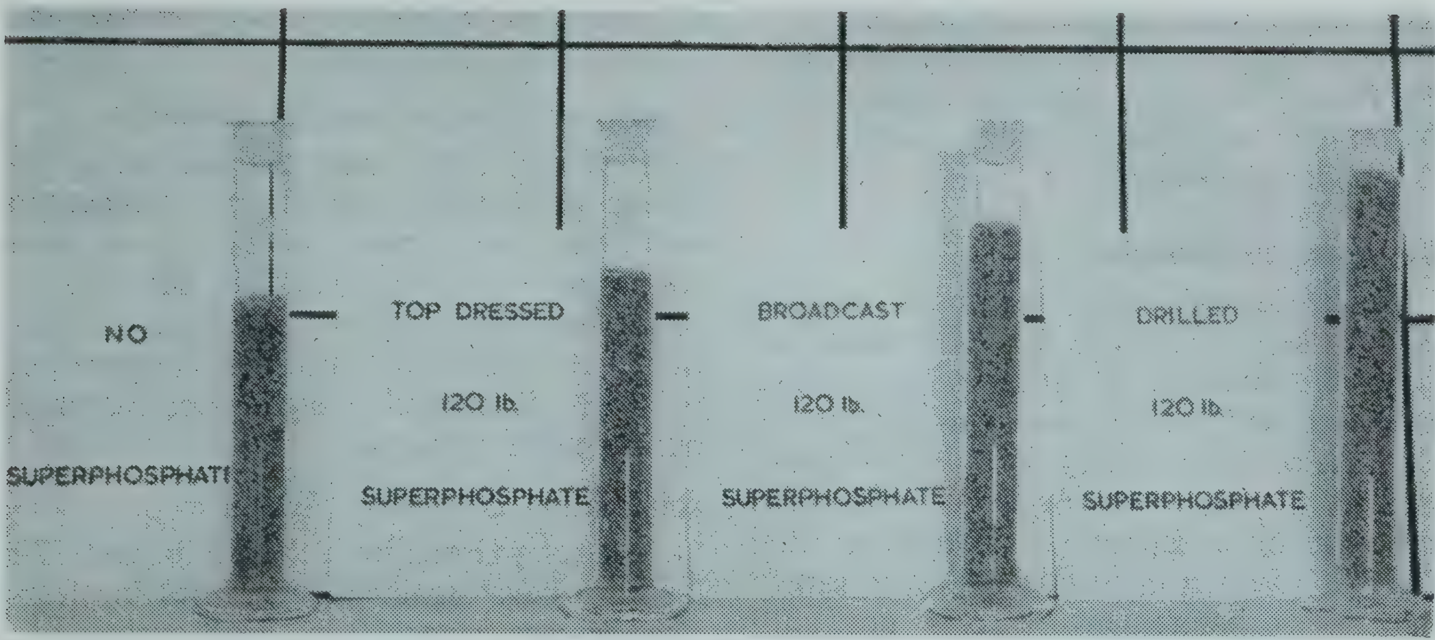
Average prices for farm-type direct drive saws are approximately £100 to £130 for 17 in. or 24 in. bar saws. Cheaper saws are available but are suitable for lighter work only. Dearer saws are also available. The higher priced saws are usually of better quality, and suitable for timber workers. Gear drive saws usually cost about £40 more than direct drive saws and are generally used for heavier work. ●

When and How to Apply Superphosphate to Wheat

A. N. SMITH



Sheaves of wheat from a 6ft. row, showing the differences between treatments.



Grain thrashed from a 6 ft. row, showing the differences between treatments

THE SUPERPHOSPHATE SHORTAGE of autumn 1964 left some wheat farmers without superphosphate at sowing time. Most farmers were loath to delay their sowing until supplies of fertilizer arrived, and the question then naturally arose, "If I have no superphosphate to apply now with the seed, will superphosphate applied on the soil later give the same yield increase?"

A query had also arisen with regard to the spreading of superphosphate on wheat paddocks before sowing. Use of bulk spreaders for this purpose appeared attractive to some farmers in that the hauling and spreading of the superphosphate were left completely to the contractor; at seed time only the wheat had to be hauled to the paddock and put through the drill.

Experiments

It is generally considered that the most efficient way to apply superphosphate to small grains such as wheat, barley and oats is with the seed at sowing. In fact, virtually all superphosphate is applied in this way. However, there have been few experiments in Australia in which the time and method of application of superphosphate were investigated. The advantages of broadcasting superphosphate before and after sowing, compared with the normal method of drilling with the seed, were investigated in two experiments. One was on the property of Mr. L. M. Kennedy at Grong Grong, and the other was at the Agricultural Research Institute, Wagga Wagga. The land at Grong Grong was unimproved, having been cleared only the previous year, and it was carrying its second crop of wheat. The land at Wagga had had a long history of superphosphate application, having received a total of 8 cwt. of superphosphate in the sixteen years prior to the experiment; it was carrying its first crop after pasture.

The wheat variety used in both experiments was Heron and both trials were sown on 13 May. The treatments were as follows:

Superphosphate broadcast before sowing at 0, 40, 80 or 120 lb. of 22 per cent superphosphate per acre;

Superphosphate drilled at sowing at 0, 40, 80 or 120 lb. of 22 per cent superphosphate per acre; and

Superphosphate broadcast after sowing at 0 or 120 lb. of 22 per cent superphosphate per acre.

The before-sowing application was made to the Grong Grong experiment on 15 April and to the Wagga experiment on 11 May.

The Author: Mr. A. N. Smith, Senior Research Officer, Agricultural Research Institute, Wagga Wagga.

The after-sowing application was made at Grong Grong on 10 June and at Wagga on 11 June. The plots were harvested on 30 November at Grong Grong and on 8 December at Wagga.

Response to phosphate

In the Grong Grong experiment the yield without superphosphate was 31 bushels per acre; the addition of 40 lb. of superphosphate caused no increase on this figure. The yield rose steadily with higher rates. Results of this kind are common on soils deficient in phosphorus. It appears that the first addition of fertilizer goes to satisfy the soil's requirements. It is not until heavier amounts are put on that the plants derive much benefit.

The situation at Wagga was different. There was a good response to 40 lb. of superphosphate, but the response declined with increasing application rates. The Wagga soil was better supplied with plant nutrients; this is demonstrated by the yield of 43 bushels per acre without superphosphate.

Yield increases

The increases in yield which resulted from the three methods and times of application are shown in the table. The figures in the last column represent the yield increases necessary before any result can be regarded as statistically significant.

Application before sowing, broadcast

At Grong Grong only the 120 lb. application produced a significant increase in yield, and this increase, of 11 bushels, was substantial; it represented an increase of about one-third on the yield without fertilizer. At Wagga the broadcast application of 40 lb. produced a significant increase, but no other rates did.

Application at sowing, drilled

At Grong Grong both the 80 lb. and 120 lb. rates gave significant increases in yield. The increase from 120 lb., 14.3 bushels per acre, is an increase of about fifty per cent on the yield without fertilizer. At Wagga the application of 40 lb. produced an increase of 6.9 bushels; higher rates did not give significant increases.

Application after sowing, broadcast

The increases obtained from the application of 120 lb. of superphosphate broadcast four weeks after sowing were similar in both experiments, being 4.7 bushels at Grong Grong and 5.3 bushels at Wagga.

If the results from the three methods are compared, those from the Grong Grong experiment show that for the 120 lb. application, broadcasting after sowing produces

Increases (+) and decreases (—) in yields caused by applying superphosphate before sowing, at sowing and after sowing

lb. superphosphate per acre	Bushels per acre 40	80	120	least significant difference
		Grong Grong		
Broadcast before sowing	—0·9	+5·4	+11·0	6·7
Drilled at sowing ..	+1·0	+9·9	+14·3	6·7
Broadcast after sowing	..	..	+ 4·7	2·7
		Wagga		
Broadcast before sowing	+7·7	+4·6	+0·3	6·1
Drilled at sowing ..	+6·9	+1·0	+3·0	6·1
Broadcast after sowing	..	..	+5·3	2·8

one-third, and broadcasting before sowing produces two-thirds of the yield increase that drilling with the seed did. When the rate was 80 lb. per acre, broadcasting before sowing produced a little more than half the yield increase that drilling at sowing did. At Wagga, broadcasting 40 lb. before sowing, and drilling at the same rate, produced comparable yield increases. The increase from broadcasting 120 lb. after sowing was only slightly lower. The reason for the higher yield increase from 120 lb. applied after sowing compared with the yield increases obtained with the same amount applied by the other two methods is not clear. Further experiments will perhaps help to define the soils on which this result is likely to occur.

Conclusions

The broadcast application of superphosphate before sowing gives no greater yield increase than drilling the fertilizer with the seed; it may even produce a smaller yield increase. On soils which do not respond greatly to added phosphorus an application of superphosphate after sowing may be beneficial. On soils which respond markedly to superphosphate fertilization, and these are the majority, the drilling of the superphosphate with the seed at sowing will give the greatest return.

ACKNOWLEDGEMENTS

The Grong Grong experiment was situated on the property of Mr. L. M. Kennedy, "Kianga", Grong Grong. His help and interest are gratefully acknowledged. Mr. K. H. Hehir was responsible for the major portion of the field work in the two experiments. ●

Feed Bees Now for Winter Needs

Now is the time to ensure that bees will have adequate food supplies to satisfy their winter needs. Extra food can be supplied either as honey in combs, or as sugar syrup.

Where a healthy hive has more than adequate reserves of honey, frames of comb can be tranferred from it to a needy hive. If a beekeeper has a few hives only, and none of them have honey reserves, sugar can be substituted.

Sugar is best fed as a syrup; mix equal parts, by volume, of sugar and boiling water. This syrup, when it has cooled to 100°F., can be fed to the hive in a suitable container.

Frame-type feeders can be bought from apiary equipment manufacturers, but a suitable feeder can be made from a screw-top jar; a milk powder tin or a jam jar is quite satisfactory. Punch about 12 holes around the centre of the lid, using a light gauge nail; a 16-gauge nail is best. Fill the container with syrup and place it upside-down in the hive.

Remove as many frames as necessary from the hive to accommodate the container, and put it on two half-inch-high cleats. This gives the bees room to get at the syrup container.

Feed in hive

Feeding of honey outside the hive is illegal. If sugar syrup is fed outside the hive, robber bees and ants might steal it from the needy bees.

If bees have no access to major honey flows and no reserves for winter they should be fed about 30 lb. of honey, or syrup equivalent, for each hive over winter.

Don't excite bees while feeding them, and don't spill syrup; spilt syrup attracts ants and robber bees. Bees should be fed at dusk, when they are not foraging. ●

Serving Agriculture—

Dareton Horticultural Research Station

J. W. TURPIN

The Dareton Station, a general view of the administration area

FRUIT GROWING PROBLEMS, and in particular those affecting the Lower Murray fruitgrowing areas, are being investigated by the Department of Agriculture at the Horticultural Research Station, Dareton.

The Station is in the Coomealla Irrigation Area, two miles from Dareton and six miles from Wentworth. This rich and progressive fruitgrowing area, on the New South Wales side of the Murray River, forms part of the intensely developed Sunraysia District of New South Wales, Victoria and South Australia. This district is well known for its main production of dried vine fruits and Riverland ® citrus.

® Registered trade name.

The Author: Mr. J. W. Turpin, Manager, Horticultural Research Station, Dareton.

The Dareton district

THE STATION

Original buildings on the Station were completed in 1954 and included an administration building, workshop and machinery shed, fuel store and cottage. Further buildings were erected between 1962 and 1964 and included a fruit packing shed, additional machinery shed and manager's cottage.

The property has a total area of 600 acres, and approximately one-third of this area has soils suitable for horticulture in some form.

First plantings were made in 1955, and planting has continued steadily until now there are 38 acres planted to citrus, stone fruit and grapevines.

Plantings are dominantly citrus, and research has been largely confined to citrus growing problems. However, a stone fruit demonstration block has been established, and the first vine planting was made in

Grapefruit trees of the stem-pit trial under spray irrigation

1964. Further citrus and vine plantings, together with one of avocado, are planned.

Rainfall is low, with an average fall of only 10.75 inches annually. Fruit production is dependant on irrigation for most of its water requirements.

Summers are hot and winters mild. During the summer months, pleasant cool changes occur, which keep the mean daily temperatures down to 77°F. for February, the hottest month.

Water supply and irrigation

The Water Conservation and Irrigation Commission provides a water supply to the north-east corner of the property during their normal roster irrigations. From this point, the Station pumps its water through underground pipelines to all plantings, which are spray irrigated.

An independent deep drainage disposal system has been built which will be adequate for all the deep tile drainage, and will also provide an overflow for the irrigation pump.

All plantings are spray irrigated by permanently located overhead sprinklers which are attached to underground systems.

Several designs have been incorporated into the spray irrigation layouts, and include sprayheads located on square, rectangular, equilateral and isosceles triangular patterns.

Various materials have been incorporated into the spray irrigation layouts. These include systems of concrete pipes with plastic off-takes; asbestos pipes; polythene plastic pices; P.V.C. plastic pipes; but, regardless of what materials were used in the reticulation system, only 1-in. galvanised iron water pipe has been used for the overhead sprinkler uprights.

CITRUS RESEARCH

Citrus research projects involving tree plantings are generally long term, because of the time taken for trees to crop and mature. Trials that take 15 to 30 years to complete are common. Trials of short duration, 1 to 5 years are superimposed on plantings established for that purpose. Both

View of the stem-pit of grapefruit trial planted in 1959

Spray irrigation of the spacing trial

types of trials, long and short term, are being conducted at Dareton.

Long-term citrus trials planted are:

Orange stock and variety trial;

Stem-pit of grapefruit trial; and

Valencia double planting trial.

Orange stock and variety trial

The orange stock and variety trial will compare three selected strains of the varieties Valencia and navel on three rootstocks. This means that nine combinations of varietal strains and rootstocks are compared for each variety.

1. Variety: Valencia.

   Strains: Newton, St. Ives, Allen.

   Rootstocks: Sweet orange, rough lemon, trifoliata.

2. Variety: Navel.

   Strains: G.V.N., Herps, Leng.

   Rootstocks: Sweet orange, rough lemon, trifoliata.

Stem-pit of grapefruit trial

Stem-pit is a virus disease which attacks grapefruit. It causes dimpling or pitting of the tree butt, mis-shapen and small fruit, and gradual decline of the tree. Departmental biologists have indexed the virus by use of indicator plants, and have determined mild and severe forms which can be transmitted by citrus aphids. They also determined that the trees most severely affected by Stem-pit are those which have been free of the disease, and are then infected by the severe form. Trees with mild strain virus show no apparent ill effect.

In the trial at Dareton it was decided to test if virus-free trees could be inoculated with mild strain virus to protect them from the severe form of virus.

The Stem-pit trial block therefore contains trees indexed free of virus, and trees inoculated with the mild and severe forms of Stem-pit. This arrangement permits citrus aphids to move freely over these trees, and will test the commercial feasibility of the inoculation system as a control for this disease.

Because the future of the grapefruit industry depends on the control of Stem-pit, another section of this trial has been planted to test the resistance of various seville rootstocks to the Stem-pit virus. Preliminary glasshouse trials at Rydalmere indicated that seville stocks appeared to inhibit symptoms of the disease.

Valencia double planting trial

A trial which compares double planting with normal planting, will prove very interesting in years to come. Double planting (planting 24 ft. x 12 ft. instead of 24 ft. x 24 ft.) has been practised widely in Murray River districts in recent years. The trees gradually grow into one another, and growers are eventually faced with the problem of deciding whether to leave their trees as a hedge, or when to thin to normal spacing.

The economics of double planting is the most important feature, as double planting is practised to increase the return per acre when trees are small. Therefore what at first appears to be a simple comparison of single and double planted trees, becomes more complex when these aspects are considered.

The double planting trial at Dareton is so designed to permit a statistical comparison of normal planting with double planted trees which can be thinned at various intervals, of say 10, 15 and 20 years.

Citrus arboretum

A collection of citrus species was commenced in 1955, and now over one hundred types, varieties and strains of citrus are included in the block of trees.

The collection will provide material for future plant breeding projects. In the meantime, it gives a guide to the performance of some of the less well-known species under Lower Murray conditions.

Short term citrus trials

A block of citrus, with all major varieties represented, was planted in 1955 to permit the conduct of short-term trials.

One trial covering the control of soft brown scale has been completed. It gave valuable information on the degree of biological control of soft brown scale which was facilitated by the control of ants.

Currently a weedicide trial on a block of Ellendale mandarins is being conducted over a number of years. This trial will test the effectiveness of various herbicides in weed control, and the influence of these materials

Spring cultivation in the stone fruit demonstration block. The driver is using a tractor-powered under-tree rotovator.

on tree health. To date it has been demonstrated that pre-emergence weedicides have a definite place in citrus culture, particularly for control of "under tree" weeds in double planted blocks.

Another current short-term investigation involves means of influencing the population of the common golden eye lacewing, as the larvae are predators of many of the common fruit tree pests of the Murray.

Accurate varietal assessment, and fruit descriptions on many of the citrus varieties and strains maintained in the aboretum, are also in progress.

OTHER RESEARCH

Stone fruit demonstration block

Stone fruit plantings have been made since 1957, and a considerable collection of varieties has been built up to demonstrate their performance under local conditions.

This demonstration block includes the following number of varieties: Peaches—dessert 15, canning 14; apricots—9; and plums—7.

A recent project commenced on the stone fruit block will investigate the effect of various materials on the condition referred to as budshedding of peaches. This condition, which appears to result from inadequate chilling of the dormant trees, causes buds to die and drop before blossoming, with the result that poor crops follow.

Vines

The first vine planting of selected sultanas was made in 1964 and it is intended that this block will provide vines for short-term trials. Further vine plantings are planned to investigate various aspects of culture and production.

Research future

The Horticultural Research Station at Dareton has now progressed to the stage where initial trial plantings are maturing, and are beginning to show interesting results. This Department feels confident that the Station will make a considerable contribution to the horticultural research of the Murray Valley, New South Wales, and Australia. •

CHAFFING CAN BE WASTEFUL

Chaffing or hammer-milling of hay for dairy cows might not be warranted.

Chaffcutters or hammer-mills reduce the more obvious waste usually caused by spilling and trampling.

Cows usually eat most of any hay put through a chaffcutter or hammer-mill. But if the hay is cut or ground too finely it tends to pass through the intestines too quickly for proper digestion. Consequently, much food value is lost. If hammer-mills are used, the coarsest screen should be fitted.

Wastage of hay from racks by spilling and trampling can be eliminated by fitting footboards or a wide, shallow trough below the rack. Much arduous and dusty hammer-milling or chaffing can be avoided if this attachment is fitted to a hay rack. •

Dehorning Merino Rams Won't Stop Poll Strike

A. R. CLARK

DEHORNING has been practised on cattle for many years. If Merino rams could also be dehorned it would be of great benefit to the industry by reducing poll strike.

However, investigations into various dehorning methods show that Merino rams cannot be successfully dehorned. Irrespective of what method is used, weak horn growth will occur, and cannot be prevented by subsequent treatment. Furthermore, because these weak horns are not firmly attached to the skull they are easily broken by fighting or handling in yards. In addition to this weak regrowth, there is an increase of loose, flaky material around the dehorned area.

An old Merino ram. Its horns were cut back some years ago.

Flaky growth and broken, bleeding horns are very attractive to flies and dehorned rams are more susceptible to poll strike than untreated horned rams.

Methods of dehorning

To test the effectiveness of various dehorning methods, trials were conducted at Trangie Agricultural Research Station using Merino ram lambs. In the original trials, some rams were treated with caustic soda, while others were cauterized with hot irons.

Many of the ram lambs treated with caustic soda died, while quite a number of the survivors had permanent head wounds.

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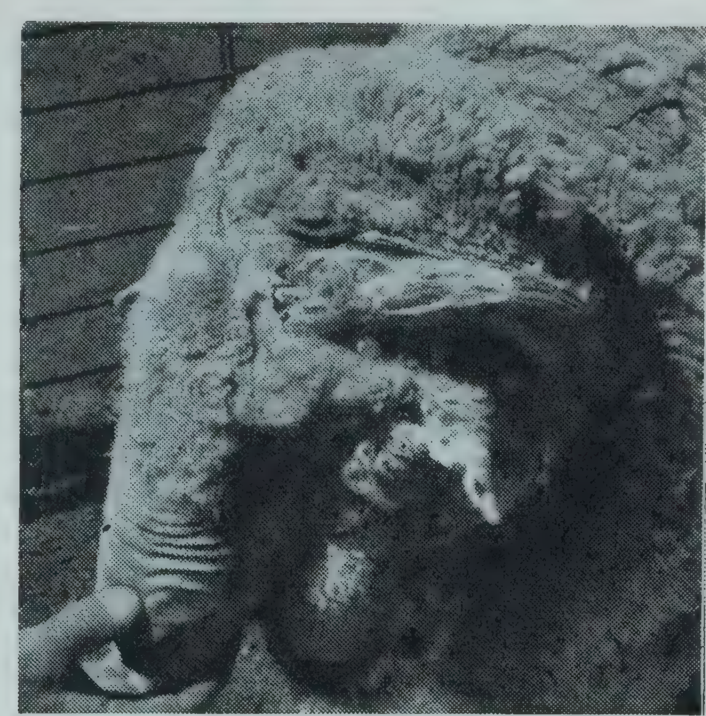

Another old Merino ram dehorned several years ago. One horn has been broken off short, and the other is badly cracked and flyblown.

These wounds, together with misshapen and broken horns, resulted in a lot of poll strike.

Hot iron treatment was not as severe as caustic soda. No losses occurred after treatment and there were no permanent head wounds or severe fly strikes. Nevertheless, twelve months after treatment there was very little difference in horn growth between treated and untreated rams.

Horn of a Merino ram marked to show where to cut.

Because of the failure of these early methods, surgical dehorning was attempted. The horn buds were cut out, and some of the surrounding skin removed. Fast work is only practicable with lambs less than a week old, as the horns quickly become too large for easy removal. The operation was carried out in association with tailing and ear marking, ram lambs being treated at a rate of more than one per minute.

The ram lambs treated in this way quickly recovered, but retained their ability to produce horn growth. Because they had no bone core, these growths were loosely attached to the head, and broke off very easily. Broken horns were always replaced by similar weak growths which were just as prone to further breakage. At eight months of age, half of these rams had at least one broken horn and all of them had been struck.

Trimming of horns with secateurs did not arrest regrowth or reduce susceptibility to fly strike. Repeated jetting was necessary to prevent severe poll strike. It was obvious, therefore, that these rams would be very

One way to cut horns is to use a butcher's saw.

prone to poll strike for the rest of their lives.

In an endeavour to prevent regrowth, a second group of ram lambs was treated twice. The same surgical methods were used as before, but allowing a month between treatments. By removing more skin from the horn site, regrowth was slowed down, but many rams still produced horns large enough to be damaged by fighting and yarding.

Associated with the double operation was an increase in loose, flaky material close to the head. This was very attractive to flies.

Conclusions

The skin surrounding the base of rams' horns is different to that found on cattle. With rams it continues to produce horny growth, even when the horn itself and a margin of skin are completely removed. This makes successful dehorning impossible.

It is evident from these trials that the dehorning of Merino rams will not control poll strike. This then leaves strategic jetting as the only satisfactory control of poll strike in horned Merino rams.

Although complete dehorning is impracticable, some of the horn can be removed with safety. By sawing horns off as far back as the curl, rams will be much easier to handle in yards, particularly through a race. However, it is not advisable to cut horns off too close to the head as the ends may split and crack, leaving an opening attractive to flies.

Finally, where complete removal of horns is desired, the only satisfactory way is to breed hornless sheep by using poll rams.

ACKNOWLEDGEMENT

This article is based on the paper "The Surgical Dehorning of Merino Ram Lambs", by R. B. Dun, published in *Australian Journal of Experimental Agriculture and Animal Husbandry*, Volume 3, No. 11, November, 1963.

ARTIFICIAL DRYING OF WHEAT

Outstanding Success at Merriwa

P. H. HODGE

Mr. K. H. Nutt, owner of the drier at Merriwa, at the delivery outlet of one of the self-emptying bins.

PRODUCTION TECHNIQUES in the Australian wheat industry have progressed rapidly in the last decade. The most spectacular change has been the introduction of bulk handling techniques associated with larger harvesting machinery and more efficient handling of the harvested grain.

But a serious problem has arisen in the bulk handling of wheat, particularly in the better rainfall areas. It is that wet weather at harvest time results in grain being too moist for bulk storage.

To justify the use of grain drying equipment, which in the past has been considered impractical and unnecessary, the results achieved need to be convincing.

A wheat dryer designed by the Upper Hunter County Council was operated at Merriwa last season with outstanding success. The most surprising aspect was that the cost of drying the grain was less than one penny per bushel for the electricity used.

It was possible to harvest wheat 38 hours after rain at a moisture content of 14 per cent and reduce the moisture level to 11.6 per cent in less than 24 hours. In this particular instance the load of 380 bushels was dried using 73 units of electricity at the rural rate of 2.7d. per unit, costing approximately ½d. per bushel.

In unseasonal weather, high humidity can persist for appreciable periods, holding the moisture level of the standing crop at 14 per cent. To be accepted by the Grain Elevators Board, wheat must contain no more than 12 per cent moisture.

Construction of the dryer

The storage section of the dryer at Merriwa (see diagram) consists of five bins each of 380 bushels capacity (one full truck load) welded together side by side to

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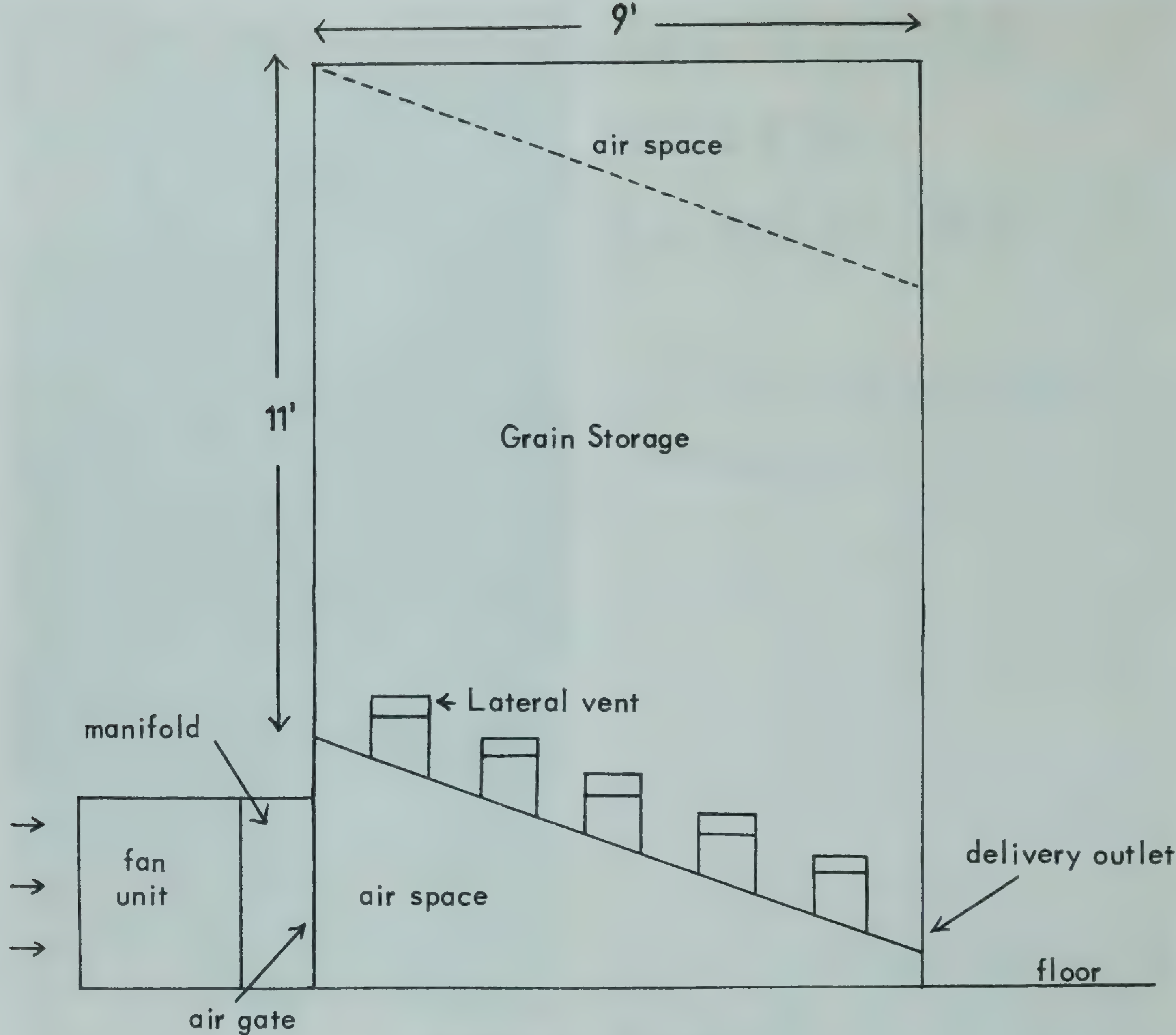


Sectional view of the dryer

give a structure 25 ft. long x 14½ ft. high at the rear by 9 ft. wide. The floor of the bins slopes to the front to allow the bins to empty completely without the need for shovelling. The slope of the floor is 18°. As wheat stacks naturally at 20°, an even grain depth is achieved by augering the grain into the rear of the bin. The maximum recommended depth of the grain to be dried is ten feet.

As the air is blown through, drying commences in the lower layer and the drying zone moves at a steady rate from the bottom to the top of the grain mass.

The recommended air requirement for drying wheat is one cubic foot of air per minute per bushel. A higher rate of air flow will of course mean faster drying, however, drying costs will increase considerably.

The air space under the sloping floor is enclosed, with an air inlet vent fitted with an adjustable shutter. Vents are fitted in the bottom of the bins to distribute air evenly through the wheat. At the rear of the bins a duct runs the length of the bins to serve as a manifold from the ventilating fan.

Fully loaded the fan demands just under 3 h.p. and ventilates the full load of 1,900 bushels (50 tons approximately) efficiently.

The air used in drying the grain has two main functions; to supply heat for evaporation of moisture, and to carry away the evaporated moisture.

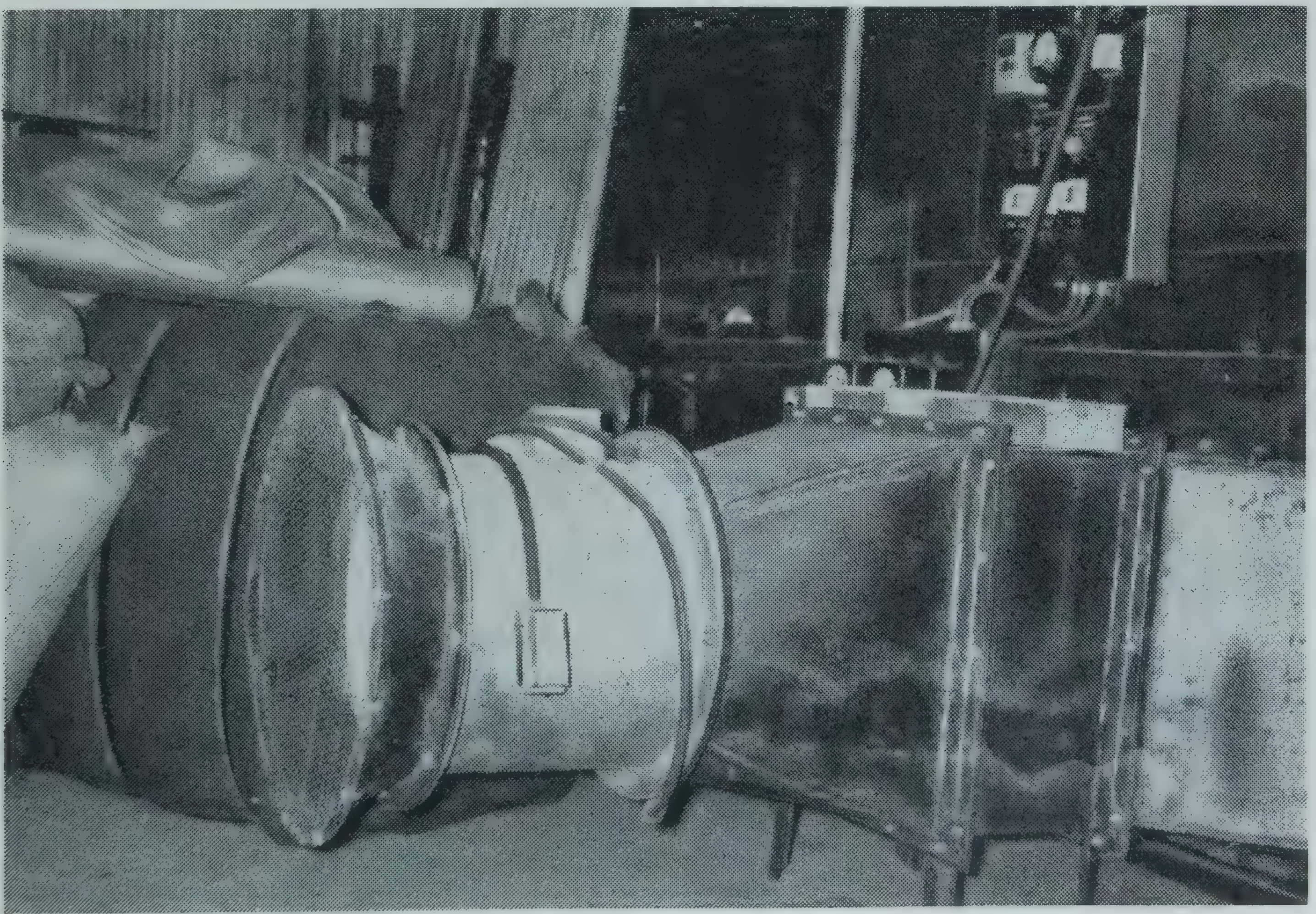
There is a limit to the amount of water that air can hold at any given temperature. The amount of water the air can hold increases as the temperature rises.

Mr. Nutt at the fan. The control panel can be seen on the wall of the storage bin.

The equipment is designed to operate as far as possible without heat assistance. While the relative humidity of the ingoing air remains below 60 to 65 per cent at normal air temperatures the grain is dried the same as if it were in the field. The relative humidity is the ratio between the amount of water the air is carrying to the amount it could carry at the same temperature when fully saturated.

When relative humidity of the ingoing air becomes too high, as is likely during wet weather or at night, moisture is absorbed from the air into the grain. To overcome this the air taken in by the fan is monitored by means of a humidistat. This switches on a preselected number of radiating elements that raise the ingoing air temperature, so reducing the relative humidity.

The total cost of materials, labour and electrical installation used in the construction of the dryer was approximately £1,160.



The single stage fan unit connected to the heating chamber. Air from the fan unit is ducted to the five grain storage bins.

Theory of grain drying

There is a direct relationship between the moisture content of grain and the relative humidity of the surrounding air. Accompanying is a generalized table showing this relationship.

Temperature and humidity of air required to dry grain to various moisture contents

Grain Moisture %	Temperature 40°F	60°F	77°F
	Relative humidity %		
17	78	83	85
16	73	79	81
15	68	74	77
14	61	68	71
13	54	61	65
12	47	53	58

From the paper " Grain Drying with Forced Ventilation " by J. W. Roebuck.

This table shows for example that to reduce the moisture content of the wheat to 12 per cent, the relative humidity of the drying air must be no higher than 58 per cent when the temperature is 77° or 53 per cent when the temperature is 60°.

At every level of temperature and relative humidity there is an equilibrium grain moisture level. At this level the rate of moisture loss from the grain to the surrounding air is equal to the rate of moisture gain from the surrounding air.

When atmospheric relative humidity is below 60 per cent, drying of the grain is achieved simply by forced ventilation with natural air. However, during wet weather or at night, relative humidity will rise. For this reason it is necessary to have control of the humidity of the ingoing air. The most economical method of achieving this is by raising the air temperature.

An increase in temperature of 10° F. can depress the relative humidity by about 20 per cent.

In an extreme case, with an air temperature of 100° F., and 96 per cent relative humidity, when the air temperature is raised 10° F. relative humidity is reduced to 65 per cent.

Drying of the grain involves removal of moisture from the grain surface and movement of moisture within the grain to the surface by diffusion.

If the grain is heated to 120° F. it is likely that the rate of moisture diffusion within the grain will not be able to keep up with the rate of moisture loss from the surface. This causes the surface to dry out and become hard, trapping moisture inside the grain. In this condition the grain is no longer suitable for milling.

Temperatures above 120° F. will also affect the germination of seed.

In the drying of grain at Merriwa it was never necessary to raise the temperature of the drying air above 100° F. The grain was dried as it would have been in the field.

Uses of the dryer

The advantages of grain drying are several. Harvesting can be commenced as soon as the crop will strip, with the knowledge that a grain moisture content above the 12 per cent set by the Grain Elevators Board can be cheaply and readily reduced by mechanical drying before delivery at the Board's receiving depot.

If harvesting is delayed, weed growth often causes mechanical difficulty in harvesting.

Drying permits long-term storage of grain without deterioration. By removing moisture, the possibilities of overheating, and reduction of germination ability are reduced.

Grain can be delivered during periods of inactivity at the bulkhead following wet weather.

The dryer as it is constructed can handle other grains such as grain sorghum, maize, barley and seed of fodder crops.

ACKNOWLEDGEMENTS

The writer acknowledges the information and assistance given by Mr. K. H. Nutt of Merriwa, owner of the dryer; Mr. H. J. Smith, of the Monaro County Council, formerly of the Upper Hunter County Council, who designed the dryer, and Mr. J. W. Roebuck, B.E., of the Electricity Authority of New South Wales.

Much higher production would be obtained from this Semillon vineyard in the Hunter Valley if the row spacing were not so wide.

GRAPEVINES YIELD BETTER WITH CORRECT SPACING

A. F. MURRAY

THERE IS GREAT VARIATION in the planting distances used for grapevines throughout the world. In the cool Champagne region of France, 3,000 or more vines per acre is normal, while the corresponding figure in the hot, dry districts of Spain is only a few hundred.[1]

Over the years, vine spacings have become standardised in most Australian districts. Along the Murray River for example, sultanas are invariably planted with a row spacing of 11 feet, and 8 feet between the vines in the row.

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Table 1.—Number of vines per acre at various spacings

Vine spacing within row (feet)	Row spacing (feet)				
	10	11	12	13	14
5	871	791	726	670	622
6	726	660	605	559	519
7	622	566	519	479	445
8	545	495	454	419	392
9	484	440	403	372	346
10	435	396	363	335	311

However, there is still considerable variation in the Murrumbidgee Irrigation Areas, where, in many instances, production has been sacrificed by planting vines too far apart.

Number of vines per acre

The number of vines required to plant an acre at normal planting distances is shown in table 1.

The number of vines in a given area can be calculated by dividing the area, in square feet, by the product of the planting distances in feet. For example:

Area 350 ft. × 400 ft.

Planting distance 10 ft × 7 ft.

Number of vines =

$$\frac{350 \times 400}{10 \times 7} = \frac{140{,}000}{70} = 2{,}000$$

(Note.—Number of square feet in an acre = 43,560.)

Research results

Experiments at the Viticultural Research Station, Griffith, tested the production of vines planted in a range from 227 per acre (14 ft. × 14 ft. spacing) to 544 per acre (10 ft. × 8 ft. spacing). Here, the yield per acre increased considerably as the number of vines increased.

The results indicated that the best number of vines per acre lies between 500 and 600 under M.I.A. conditions.

These findings are supported by grower experience and by experiments in California where, under similar conditions, the recommendations are much the same.

In a recent experiment in South Australia(2) under non-irrigated conditions, the production of Grenache wine grapes, planted at 360 vines per acre, was the same as those at 600 per acre when the widely spaced vines were permitted to carry more spurs. It was concluded that the number of vines had little significance, provided the total number of fruiting spurs per acre was the same.

Row spacing

Row spacing is largely governed by accessibility. The size of cultivation implements and power sprays now in use necessitate reasonable row widths if vine injury is to be avoided.

The minimum row spacing in the irrigation districts is 11 ft., and this is used for all varieties in the Murray districts. Nevertheless at this spacing the more vigorous varieties, like sultana, usually require light slashing to facilitate cultural operations.

For irrigated wine grapes, where the crop is often directly bulk loaded on to trucks in the vineyard, a row spacing of at least 12 ft. is necessary for all except the least vigorous varieties, like Gordo Blanco, where 11 ft. is adequate.

On the M.I.A., row widths of up to 18 ft. have been used, the object being to cut down on trellising and spraying costs by having fewer rows to cover. Such spacings are excessive, as to maintain the desired number per acre the vines must be unduly cramped in the rows.

The minimum row spacing in non-irrigated districts where the vines are smaller, is 10 ft. Nevertheless under good growing conditions the more vigorous varieties should be given 11 ft. between the rows.

Spacing in the row

The wider the row spacing, the closer vines must be within the row to obtain sufficient vines per acre. The vigorous varieties like sultana and Black Shiraz need sufficient room to facilitate pruning and training. Cramping such varieties makes their management difficult and is likely to reduce yields.

Table 2.—Recommended planting distances for grapes

Variety	Irrigated		Non-irrigated	
	Row	Vine	Row	Vine
	(feet)	(feet)	(feet)	(feet)
Vigorous—wine, e.g., Black Shiraz ..	13	7	11	7
Vigorous—drying, e.g., Sultana.. ..	11	8	..	..
Moderately vigorous, e.g., Semillon, Doradillo and Black Muscat ..	12	7	11	6
Low vigor, e.g., Gordo Blanco ..	11	5	10	5

Under irrigation, vigorous and moderately vigorous varieties should not be planted closer than 7 ft. apart but varieties of low vigour may be planted as close as 5 ft. apart in the rows.

In non-irrigated districts vines can be planted a little closer in the rows under most conditions. It will be appreciated, however, that under-the-vine cultivation becomes more difficult the closer together the vines are planted.

Recommendations

The recommended planting distance for grapevines are summarised in table 2. These recommendations are based on the assumption that the vines are planted on fertile soils. Slightly closer planting distances may prove better on poorer soils.

Factors such as the height and type of the trellis have an influence on the spacing chosen. For example using a T-trellis where there are four instead of two arms, the vines could be planted a little closer in the rows. On the other hand, with a high trellis the rows could be a little closer as there is less tendency for the canes to run along the ground.

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(2) "Nurioopta Viticultural Research Station seeks the Answers to Dry-land Vineyards". *Journal of Agriculture of South Australia*, **64**; 6, p. 246. Jan. 1961.

ACKNOWLEDGEMENT

The author wishes to thank Mr. G. R. Gregory, Principal Fruit Officer (Viticulture) for help in preparing this article, particularly in reference to non-irrigated vineyards.

Watch Those Milk Cans

Dirty and damaged milk cans can spoil the best quality milk or cream and cause it to be down-graded or even rejected.

Six points

- Wash cans thoroughly and use proper washing solutions of the correct strength; rinse well after washing.
- Sterilize cans with steam or boiling water so that they will dry; keep them upside down on racks in a dry place even though they are stored for a few hours only.
- Do not allow sour milk or cream to remain in cans for any length of time.
- Leave lids off empty cans when they are not in use.
- Avoid damaging the inside of cans.
- Keep cans in use; don't store them for long periods.

Livestock Health Notes

J. S. HEALEY

CLOVER DISEASE IN SHEEP

MANY YEARS AGO research workers in Western Australia discovered that some subterranean clover may contain hormone-like chemicals known as oestrogens. They also established that these substances interfered with fertility.

Subterranean clover containing a high oestrogen level can render sheep permanently sterile. Sheep grazing at mating time on pasture containing moderate levels of oestrogens become temporarily infertile, causing reduced lambing percentages. Similar effects have been caused by red clover and, to a lesser extent, lucerne.

Serious infertility arising from clover pastures is only occasionally reported in New South Wales. Either subterranean clover or red clover has been involved in these cases. Nevertheless there could well be many cases where a lambing percentage is reduced by up to 25 per cent on this account.

There is a practical means of determining whether or not clover pasture is safe. It entails the use of wethers which have not grazed on clover for six weeks. Ten wethers are used to test the suspected pasture. Each wether is identified and the length of its teats measured and recorded. After 7 to 10 days on the pasture the teat lengths are again measured. An increase in teat length of one quarter of an inch or more indicates that the pasture contains risky quantities of oestrogen.

Different varieties of subterranean clover vary in the extent to which they develop oestrogens. Lowest activity is in Mt. Barker, Bacchus Marsh and Clare strains. The highest concentrations of oestrogen are found in the Yarloop and Dwalganup varieties. With each of these, activity has been found to vary in different localities. In the case of red clover the oestrogen content shows a seasonal pattern of activity. It is highest in the autumn and spring and lowest in winter and summer.

A point worth noting is that seed of a particular strain of subterranean clover purchased for sowing may contain small quantities of the seed of other varieties. If the environment is unfavourable for the main strain, this may rapidly be replaced by other strains which were originally present only as contaminants. These could be more oestrogenic than the original variety.

The C.S.I.R.O. is attempting to breed new strains of subterranean clover in which oestrogens will be absent, or present in only minute quantities.

FOR BEST RESULTS FROM STRAIN 19

IF, in addition to having your own cattle vaccinated with strain 19, you can persuade your neighbours to do likewise, you will be helping yourself. Strain 19 has been proved in many countries of the world to give cattle good protection against brucellosis. However it does not provide complete immunity.

Naturally, therefore, the amount of protection obtained will be influenced by the potency of infection to which vaccinated cattle are afterwards exposed. Vaccinated cattle exposed to large numbers of highly virulent organisms are more likely to contract brucellosis, and abort, than vaccinated cattle exposed to only mild infection.

An unvaccinated neighbouring herd can be a source of virulent infection to a vaccinated herd. If, on the other hand, the level of infection has been reduced on adjoining properties by a programme of strain 19 vaccination, spread of potent organisms from one property to another is less likely.

Best results are therefore obtained when strain 19 is used on an area basis. However even if adjoining owners do not have

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their cattle inoculated, use of the vaccine in a herd is still well worth while.

OVER-MILKING CAN CAUSE TEAT DAMAGE

SCIENTISTS PROVED many years ago that typical mastitis developed only when udder or teat injury took place and certain bacteria were present. When one occurred without the other, there was no mastitis. Much research has gone into the udder and teat injury question. Inefficient milking machines, badly fitting cups and over-milking have been shown to be causes.

Recently some experimental work was carried out to determine precisely the harm resulting from over-milking. Machines that operated normally were left on cows for periods varying from 5 minutes to 20 minutes after milking had been completed. The cows were then slaughtered and the amount of tissue damage assessed on post-mortem examination.

The experiment confirmed that excessive milking did cause serious injury to the interior of the teats. The lining membranes showed swelling, bruising and haemorrhage. A finding was that teats subject to numerous short periods of over-milking suffered less injury than those over-milked on fewer occasions but for longer periods. Thus cows over-milked by 20 minutes on each of four occasions sustained more injury than those over-milked by 5 minutes on 16 occasions.

CALF TROUBLES

THE DEATHS OF CALVES at or shortly after birth are reported from time to time. There are many causes. One of these is a condition scientists call arthrogryposis. A simpler term is "curly calves".

It is a condition which seems to be occurring with increasing frequency, particularly on the far south coast and adjoining tablelands. In this area it is estimated that some 1,200 cases have occurred in the past twelve months. Usually only a few cases occur in any one herd. On a few properties up to 40 per cent of calves born during a limited period have been affected.

Curly calves are usually malformed. They are smaller than normal and have deformities of limbs and at times of the body. Usually the limbs are flexed. Because of contraction of tendons, the legs cannot readily be straightened. Naturally these abnormalities make delivery of the calves difficult, and assistance at birth is often necessary. On occasions, curly calves have normal limbs but after birth are found to be blind, weak and unable to suck properly.

Investigations have shown that curly calves have degenerated brains or nerves. The cause of these changes has not been determined.

ENTEROTOXAEMIA LOSSES IN CATTLE

Enterotoxaemia—sometimes called pulpy kidney when it affects lambs—is a well recognised disease of sheep. Less well known is the occurrence of the disease in cattle. Some little time ago enterotoxaemia caused the deaths of 22 out of 130 head of cattle in the Hunter Valley.

Like the disease in sheep, enterotoxaemia causes rapid death in cattle. Deaths are most likely under conditions of lush pasturage. Following death, there is rapid decomposition. This effect, together with the conditions under which enterotoxaemia usually occurs, has frequently led to the disease being confused with bloat. In fact where cattle are not seen sick, it is often difficult to determine whether deaths have been caused by enterotoxaemia or bloat.

Vaccination of cattle has been undertaken as a means of prevention. Generally, but not in all cases, the results have been good. One possible explanation for the failure of vaccination is that not all cases of enterotoxaemia in cattle appear to result from the enterotoxaemia organism of sheep referred to as *Clostridium perfringens* type D. It is from this organism that vaccines are made. There is evidence that some outbreaks of enterotoxaemia in cattle may be caused by type E organisms, while there is suspicion that types B and C may also occasionally be involved. Work is being carried out at the Department's Veterinary Research Station, Glenfield, to type as many as possible of the causal organisms responsible for outbreaks of the disease. •

Sub-tropical Grasses for Grazing

Observations and Analyses at Grafton Agricultural Research Station

G. WILSON and B. BARKUS

SEVERAL TRIALS have been established at Grafton Agricultural Research Station to evaluate grasses and legumes under grazing. This article gives a brief account of some grass species studied during the period 1954 to 1964.

Grafton Agricultural Research Station is situated at L. 152° 58′ E., 29° 38′ S. at an altitude of 50 feet. The mean rainfall is 39 inches, falling mainly between December and April.

A trial was sown on 20 December, 1954, to compare the yield and behaviour under grazing of five sub-tropical grass species on upland red clay loam—an alluvial soil type of rare occurrence in the Clarence River basin.

Species sown included Rhodes grass (*Chloris gayana*) Australian commercial strain, South African pigeon grass (*Setaria sphacelata*) Kazungula strain, green panic (*Panicum maximum var. trichloglume*), Pensacola Bahia grass (*Paspalum notatum*) and paspalum (*Paspalum dilatatum*). They were sown on a prepared seed-bed in unreplicated half-acre plots, the seed being drilled in rows spaced 42 inches apart.

The Authors: *Mr. G. Wilson, Agronomist, Agricultural Research Station, Grafton, and Mr. B. Barkus, Chemist, Department of Agriculture, Rydalmere.*

Prior to sowing, superphosphate was broadcast over the plots at the rate of 2 cwt. per acre.

Culture and management

The plots were inter-row cultivated in the establishment year to encourage the development of pure stands. In grazing management, no set pattern was followed. Duration of grazing and spelling periods were determined by the number of stock available as "grass eaters" and the rate of regrowth of the pasture. Pasture yield samples were cut on the day before commencement of grazing, ten quadrats (size 4 ft. × 2.45 ft.) being cut at random on each plot. The yields quoted are therefore only a record of the material available on that day, and are not a true record of total production. Yields quoted (see table 1) for the period 26 September, 1955, to 3 July, 1959, are not true dry matter yields, the material being sun and air dried for about six weeks. Later samples were oven dried at 105°C.

Topdressing provided the equivalent of 1 cwt. of superphosphate per acre each year. Nitrogen was supplied to the grasses in the form of sulphate of ammonia on 25 January, 1956 (56 lb. of N per acre) and 15 May, 1956 (11 lb. of N per acre), hence the yield response at subsequent cuts.

Sampling for yield ceased in December, 1960, and a grass-legume compatability study was commenced using Ladino white clover sod-seeded (on 5 May, 1961), in narrow bands between the original grass rows. An experimental rotary action sod-seeder was used.

Table 1—Yield of dry matter; lb. per acre

Date samples cut	*Chloris gayana*	*Setaria sphacelata*	*Panicum maximum*	*Paspalum dilatatum*	*Paspalum notatum*
26-9-55	311	297	287	271	139
1-11-55	526	650	538	625	278
19-12-55	681	812	688	479	321
18-1-56	977	894	1,165	638	503
19-4-56	1,116	990	785	435	252
15-5-56	2,531	2,688	2,032	600	1,210
13-8-56	1,269	504	636	265	299
21-11-56	635	865	625	454	367
21-12-56	747	765	452	373	482
14-1-57	1,203	706	560	495	739
7-3-57	643	115	676	199	199
27-11-57	681	403	762	1,111	1,259
11-2-58	433	515	469	202	235
5-5-58	1,736	1,764	1,113	504	420
22-10-58	684	328	467	94	584
22-12-58	160	363	334	97	421
2-3-59	1,998	2,144	1,799	542	1,303
1-5-59	871	711	745	396	382
3-7-59	1,319	1,546	1,037	178	311
16-11-59	3,317	2,210	1,690	669	1,213
14-1-60	909	1,221	627	707	1,497
11-4-60	85	73	59	93	129
30-12-60	491	450	235	252	557
Total ..	23,323	21,014	17,781	9,679	13,100
Mean ..	1,014	914	773	421	570

Species behaviour notes

Establishment: All five species established satisfactorily. Rhodes grass, South African pigeon grass and green panic produced the most vigorous seedlings. The young Bahia grass plants were slow to develop in the first year.

Sward formation and aggressiveness: Rhodes grass spread rapidly and was the first species to form a complete sward. South African pigeon grass and green panic were slow to spread away from the sown rows. They showed no tendency to invade other plots but were both partially invaded by Rhodes grass and weeds. Bahia grass and paspalum, though slow to develop, gradually formed dense, dominant swards. More recently it has become evident that seed of Bahia grass is spreading throughout the trial area and this species is expected gradually to become dominant.

Palatability: Stock always grazed *Paspalum notatum* and *Paspalum dilatatum* in preference to the other species but all were well grazed by the end of each stocking period. In the mature state, Rhodes grass was the least palatable species.

Persistence: With the exception of green panic, all species persisted well. It is felt that the level site, clay soil, and relatively poor drainage contributed to the disappearance of this species under grazing.

Compatability with Ladino white clover: Sod-sown rows of Ladino white clover spread and formed a dense, well-balanced sward in combination with Rhodes grass and paspalum. White clover grew sporadically in association with South African pigeon grass—but chiefly in response to good rain and heavy stocking. It failed to persist with Bahia grass except in very moist situations and close to dung patches.

Table 2—Percent protein

Date samples cut	*Chloris gayana*	*Setaria sphacelata*	*Panicum maximum*	*Paspalum dilatatum*	*Paspalum notatum*
26-9-55	10·3	12·8	12·5	13·8	14·2
1-11-55	10·0	10·6	12·9	13·8	14·2
19-12-55	9·0	10·3	11·6	11·4	11·3
18-1-56	6·9	7·8	7·6	9·1	8·8
19-4-56	6·8	8·3	7·4	9·2	8·3
15-5-56	7·9	6·7	8·1	11·1	9·1
13-8-56	8·5	13·9	16·7	19·4	15·8
21-11-56	5·1	5·3	4·9	5·6	8·3
21-12-56	6·3	8·1	7·7	8·1	9·8
14-1-57	5·8	8·1	6·8	10·7	9·3
7-3-57	5·9	7·3	5·4	9·7	9·2
27-11-57	3·6	5·2	3·9	6·6	7·4
11-2-58	6·1	6·7	8·7	12·3	12·5
5-5-58	6·4	5·5	5·0	11·9	12·7
22-10-58	4·9	5·4	5·6	9·3	12·7
22-12-58	6·7	7·1	7·4	10·1	10·3
2-3-59	4·9	6·1	6·8	6·7	5·4
1-5-59	4·2	5·3	5·3	12·7	9·1
3-7-59	4·8	5·5	6·3	12·0	9·6
16-11-59	4·4	3·5	5·2	8·9	6·7
14-1-60	4·2	5·0	4·5	6·8	6·7
11-4-60	5·9	5·4	5·8	7·5	5·3
30-12-60	5·4	4·7	5·6	5·2	4·7

Protein expressed as percentage of total dry matter

	6·1%	6·7%	7·0%	9·7%	8·1%

Dry matter and crude protein production

Tables 1, 2 and 3 show respectively dry matter production, protein percentage and protein production of the species studied in the trial.

As pointed out previously, nitrogen was applied as sulphate of ammonia at the rate of 56 lb. of N per acre on 25 January, 1956, and 11 lb. of N per acre on 15 May, 1956.

The peak protein response to nitrogen applications in *Paspalum dilatatum*, *Panicum maximum*, *Paspalum notatum* and *Setaria sphacelata* ranged from 14 to 19 per cent in August, 1956. The crude protein percentage of *Chloris gayana* (8.5 per cent) was not raised to the same extent following nitrogen applications. However, this species responded as well as the others to nitrogen application because of its very high dry matter yield and consequent high protein yield.

Without a source of nitrogen the crude protein in *Chloris gayana*, *Panicum maximum* and *Setaria sphacelata* would be insufficient for most animal requirements. On the other hand both paspalum species are fairly high in crude protein under the same conditions, but considerably lower in DM yield and protein yield. ●

Table 3—Yield of protein; lb. per acre

Date samples cut	*Chloris gayana*	*Setaria sphacelata*	*Panicum maximum*	*Paspalum dilatatum*	*Paspalum notatum*
26-9-55	32	38	36	37	20
1-11-55	53	68	69	86	34
19-12-55	62	84	80	55	36
18-1-56	67	69	88	58	45
19-4-56	76	82	58	40	21
15-5-56	200	180	165	66	110
13-8-56	108	71	106	52	47
21-11-56	32	46	30	26	30
21-12-56	47	62	35	30	47
14-1-57	69	57	38	53	68
7-3-57	19	7	18	8	8
27-11-57	25	22	11	30	19
11-2-58	26	35	40	25	29
5-5-58	111	97	55	59	66
22-10-58	32	18	28	9	74
22-12-58	11	26	25	10	44
2-3-59	25	28	16	17	30
1-5-59	83	112	94	66	119
3-7-59	41	39	47	47	37
16-11-59	58	54	54	16	21
14-1-60	139	111	76	46	82
11-4-60	54	66	37	53	87
30-12-60	46	35	34	48	62
Total ..	1,416	1,407	1,240	937	1,136
Mean ..	62	61	54	41	49

Developments in Orchard Spraying Machinery

J. F. JOHNSON

Where hand spraying is still used, certain improvisation enables the spraying to be done from the tractor seat.

THE EFFICIENT APPLICATION of insecticides and fungicides plays a major role in the successful production of most fruit types grown in New South Wales. It is only to be expected, then, that along with the steady development of agricultural machinery generally, advances would also be made with horticultural spray equipment.

There were several basic reasons why improvements in orchard spray equipment were necessary. The pome fruit industry in the tableland areas of New South Wales exemplifies the position during pre-war and immediate post-war years; most orchardists were using horse-drawn power spray units equipped with two hoses and rods or guns. All spraying was done from ground level on foot.

The Author: Mr. J. F. Johnson, Fruit Officer, Orange.

Interest runs high at an orchard field day at Orange, where various spray units are demonstrated.

With rising production costs, especially for labour, the need for reduced spraying time became essential. In 1954, for instance, many pome fruit growers were still spraying by hand, using two-man spray teams and covering about four acres a day. This, at the time, was costing for labour approximately £1 4s. per acre for each application, or £288 for a 12-spray programme to a 20-acre pome fruit orchard.

Ten years later, if the same equipment and labour units were used, it would cost £424 for labour, because of higher wages, to spray the same area.

However, during the past 10 to 15 years, progress has been significant. Now, most pome fruit-growers are using equipment capable of spraying 15 acres or more in a day, and only using a one-man unit of labour. Using such equipment the labour costs for spraying the same area have been reduced to 4s. 8½d. per acre or £56 10s. for 20 acres for the season. Financial gains have not resulted to the extent these figures might suggest though, because large, modern spray plants are not cheap, and their higher depreciation and maintenance must be taken into consideration.

The increasing awareness, too, that more speedy spray applications could considerably improve disease control lead to increased interest in development of spray equipment.

Drudgery lessened

It is also no small feature of note that advances in the development of equipment have removed a lot of the drudgery associated with spraying on foot over recently cultivated ground. Also, more time has become available for other essential orchard activities.

Development came rapidly from the late 1940's and early 1950's, when horses were largely displaced by tractor power.

Hand spraying outfits such as this were introduced in the 1920's

Hand spraying on the move with brooms from a high pressure outfit. Labour costs are high, but this is one of the best ways to beat the few "difficult" pests. Note the crawler tractor, and wide sprayer tyres to overcome boggy soil conditions.

Tractors made possible the theory of non-stop spraying, but, as at that time, there were few spray units designed or suitable for this type of work, growers' ingenuity was given free rein, and many and varied were the types of spray unit and methods of application evolved.

Pumps were coupled together to increase output; towers and platforms were constructed behind and on top of units to increase ease of operation. High pressure pumps were introduced, high pressure guns and multi-nozzle brooms were mounted on tractors, and so on. All were designed with a view to quick coverage of orchards.

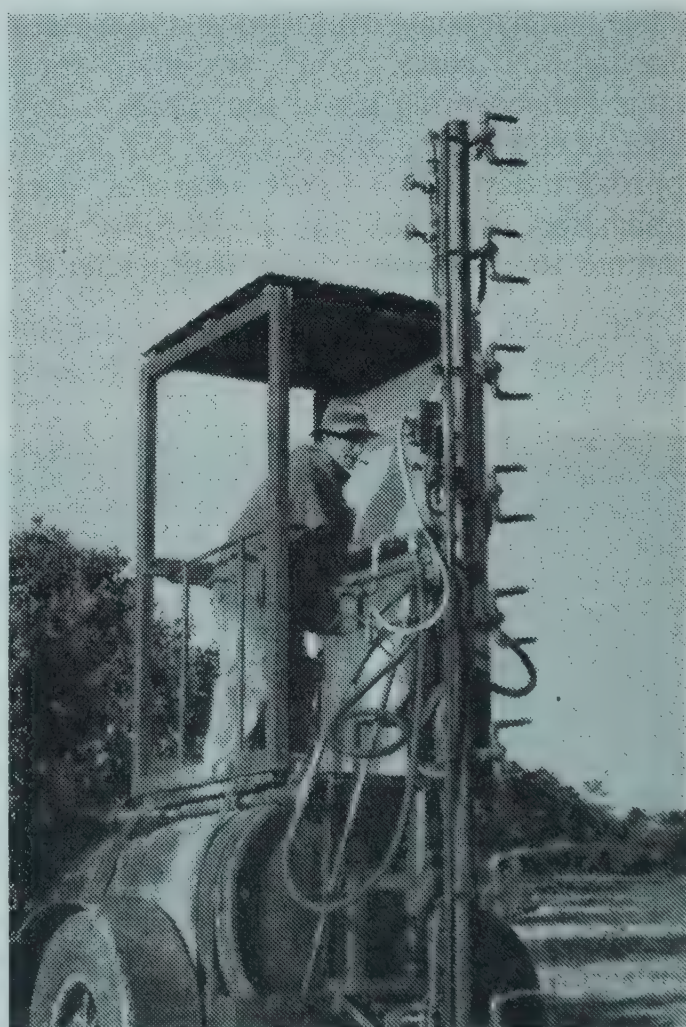
Some of these grower-designed and constructed drive-past units gave excellent service—in particular, those units equipped with hoses and brooms—maintaining pressures of up to 800 lb. per square inch.

Some fruitgrowers still retain a preference for this type of equipment, which is capable of doing a first class job. It is argued this utilises the orchard labour which has to be permanently employed anyway. It is also rightly argued that hand spraying, which permits thorough wetting, affords the best control of red spider mite. This pest has been widespread in many pome and stone fruit districts. It has not been controlled satisfactorily by many automatic units, especially semi-concentrate types.

Local manufacture

However, spray unit manufacturers were not slow in evaluating the new trend. Following the introduction of a few overseas automatic models in the early 1950's, local manufacturers were soon producing similar units of high efficiency.

The earlier models of these automatic drive-past units relied basically on high-pressure pumps delivering the spray material via multiple nozzle booms to either side of the unit. These units lacked the degree of spray penetration required for densely grown trees, and never became really popular. They have, however, in modified form been used successfully in vineyards.



Few automatic plants can effectively spray citrus trees for some pests. Usually, thorough spraying by hand is necessary.

A medium capacity P.T.O. automatic outfit. One operator using such equipment can apply about 2,400 gallons of spray in eight hours.

Really unconventional sprayers made their appearance commercially during 1953-4, mainly as what were then known as concentrate units, as they usually applied from 75 to 100 gallons per acre compared with dilute hand spraying of about 300 gallons per acre.

These were later to become known as semi-concentrate units following the introduction, a few years later, of concentrate units capable of applying from 10 to as low as 4 gallons per acre in pome fruit orchards. The latter machines never became popular. They appeared to be incapable of satisfactorily penetrating trees under any other than fairly calm conditions—a very rare phenomenon, especially along the New South Wales tablelands in the spring months when spraying is so important. Nor was the principle of concentrating chemicals to such an extent and applying such a low volume of water per acre readily accepted by most growers.

Apart from other factors, this reason has also been partly valid with the semi-concentrate units. Many growers plainly prefer to apply their sprays as dilute mixtures as they have always been accustomed to, rather than indulge in calculations involving various concentrations of different materials.

Air blast units

By the time semi-concentrate units became commercially successful the use of air blast dilute units had become well established either as entirely new units or by the conversion of hand spraying units by the attachment of another motor, turbine or fan.

The situation had now been reached when the larger growers in particular were turning to automatic units, both semi-concentrate and dilute. They did this to spray orchard areas more quickly and certainly less laboriously, and at less cost, than before

These units used air, from a turbine or fan, as the vehicle to carry spray into the trees, instead of the higher pressure pumps of the earlier types.

The initial units of semi-concentrate models delivered spray to one side only, and growers could cover something like 10 to 15 acres per day. This principle of semi-concentrate spraying was not accepted quickly by any means. It was difficult to visualise at this stage that control of pests or diseases could successfully be achieved unless trees were thoroughly wetted to the extent of plenty of visible run-off. Growers

Booms such as this, adapted for high pressure spray outfits, have proved quite successful for spraying in vineyards.

were not familiar with the necessary calculations to determine dosage rates on a tree or acre basis. They had not previously been bound by such a critical speed of travel factor.

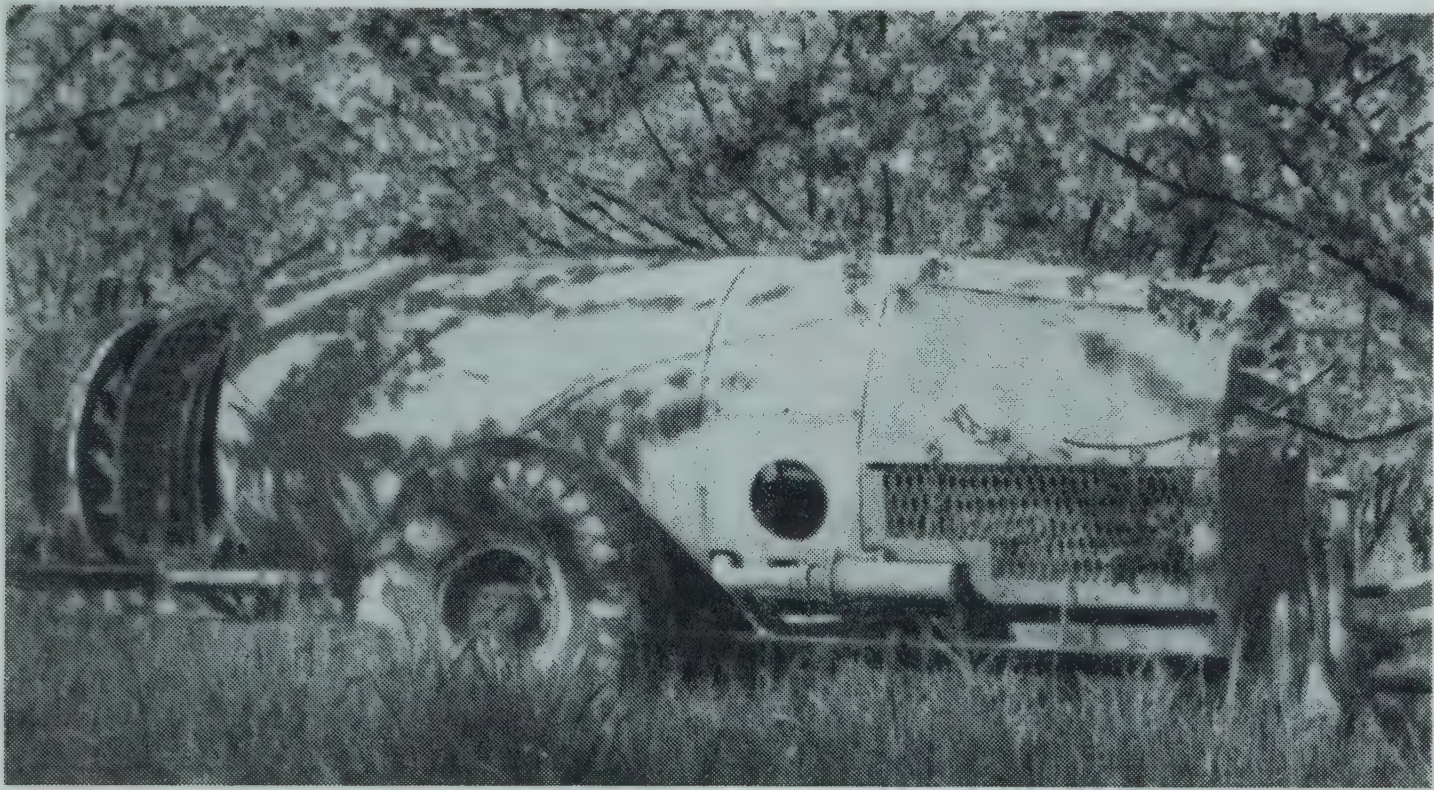
However, during the past decade this principle of spraying has been firmly adopted, and in some fruit districts there are more of this type of unit in operation than any other.

Field demonstrations have shown that spraying with semi-concentrates can be generally just as efficient as dilute units for the general run of pest and disease control, but with one notable exception. This relates to red spider, taking into account the materials available at present which can control this pest. Hand spraying units which can give better spray penetration into the centres of densely growing trees enable the most thorough control of this pest. Some semi-concentrate units operate at pressures which allow a certain amount of hand spraying for control of this pest where necessary.

Automatic, dilute-spray air-blast units comprise a large proportion of the units used by tableland orchardists to-day. They can generally be classified into those with medium and those with low pressure pumps, delivering to one or both sides, and engine functional or power-take-off operated. High pressure, dilute air blast units are at present being developed to more satisfactorily permit hand spray application where this becomes necessary.

Twin side delivery has the obvious advantage that twice the area of the single sided unit can be covered. Moderate sized air blast units can blast spray material into trees at up to 140 m.p.h. The larger capacity units make greater use of an "air displacement" factor rather than velocity. Such units will displace 40,000 cubic feet

A blanket of protection. A wide variety of power-operated machinery is available for orchardists to choose from.



A recently introduced, large capacity unit that can spray 15 acres in a day

of air per minute with wind velocity of around 120 m.p.h. to achieve the desired spray penetration.

It is believed by some that greater wind velocities tend to create a leaf barrier within the tree, whereas air displacement creates a vacuum within the tree in which it is easier to obtain maximum spray penetration.

Because of fairly wide row spacings, many growers have operated both sides under good spraying conditions. They have sprayed on one side only when it was windy, working closer to the row when travelling on the leeward side and more towards the row centre when travelling on the windward side. Designers have, however, more recently constructed "wind diverters" which are being currently attached to new units. This enables a greater proportion of the air blast stream to be diverted to the side where it is most needed, that is, to the windward side. The greater air flow permits better spray penetration to the difficult side. Natural wind makes up for the artificial wind deficit on the leeward side. The provision of this equipment is making it possible to spray successfully in weather previously considered unfavourable.

Some of the largest such units, delivering to both sides, under favourable conditions, can spray an acre of pome or stone fruit trees in 7 minutes. They deliver between 200 and 400 gallons per acre. Filling and travelling to and from filling points usually take longer than emptying the spray tank.

Engine-functioned, and P.T.O.

Engine-functioned units, that is those equipped with an engine to drive pump and fan or air turbine, are more costly to operate. This is because of the additional engine used. They are generally necessary for large capacity spray units and where orchard terrain is hilly. Power-take-off units are less expensive to operate. The one power unit of the tractor engine supplies the power for the spray pump and fan or air turbine.

The tractor power governs the availability of power for the successful operation of the spray unit. It sometimes falls short of total requirements where a larger proportion of the tractor's power is required for haulage on difficult terrain.

Under such circumstances it is often difficult to maintain the required tractor speed and still supply enough power to the pump and fan or turbine. For this reason these units are usually of small to medium proportions. Mostly they deliver spray to one side only, and have low to medium pressure pumps.

All is designed to keep operational requirements through the P.T.O. within workable limits for the size of tractor generally used by fruitgrowers. However, because of their economy in operation, these units are being widely used by growers of pome and stone fruits. These units are of small to moderate sized vat capacity and are often more advantageous under soggy soil conditions than the larger units, some of which have a spray tank capacity of up to 600 gallons.

Whilst most commercial varieties of fruit can be successfully sprayed with automatic or semi-automatic units there are several notable exceptions. Citrus are one of these as the dense outer canopy of leaves forms a barrier preventing the penetration of sufficient spray to inner leaves, twigs and branches when sprayed by the usual run of automatic air-blast units. Semi-concentrate units have generally proved unsuccessful in controlling some important citrus pests. So too have conventional dilute air-blast types. A good measure of success has, however, been achieved by automatic units using a high pressure capacity pump and oscillating boom. Even with the oscillating boom it has been found necessary with some units and large trees to keep travel speed down to 1 m.p.h. and requiring up to 20 gallons output per large tree for effective penetration and coverage.

Bananas, because of the very hilly terrain on which they are grown in New South Wales, call for spraying equipment designed to meet the situation.

In earlier years sprays in banana plantations were applied usually at over 100 gallons per acre. Under the difficult conditions encountered it took a day to cover each acre. During the last six or seven years the spraying of this crop has been made more efficient by the use of motorised knapsack-type mist units. These are in fact small concentrate sprayers which make it possible to spray an acre in half an hour.

Generally speaking, in all sections of the fruit industry orchards are being sprayed in greatly reduced times, thereby saving in labour costs. By the use of modern equipment the control of pests and diseases is, with a few notable exceptions, just as good, if not better than before. Control of some diseases is enhanced because modern spray equipment can spray a given area very quickly.

When protective sprays as well as eradicant sprays are being used, as in the control of apple scab, the speed of application is of vital importance in achieving satisfactory control.

Taking this particular disease as an example, today, with modern equipment, one person can spray up to 30 acres in two days. Fifteen years ago it would generally have taken twice the labour four times as long to spray the same acreage. It was often a case of time to spray again immediately following completion of one round.

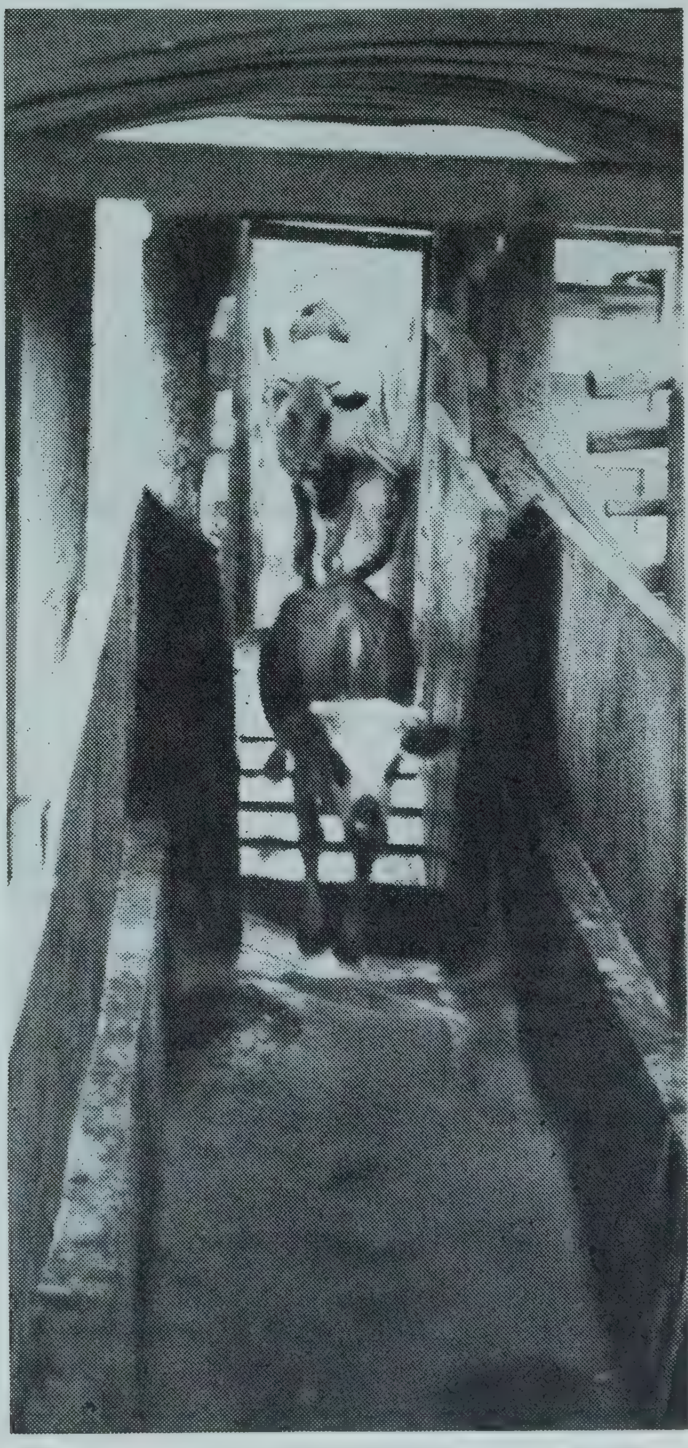
Everyone would agree that spraying today is a much more pleasant necessity than it used to be. ●

Some Activities of the Board of Tick Control Laboratory

J. H. P. DINGLE

THE LABORATORY of the Board of Tick Control plays an important part in the control of cattle tick on the far north coast of New South Wales.

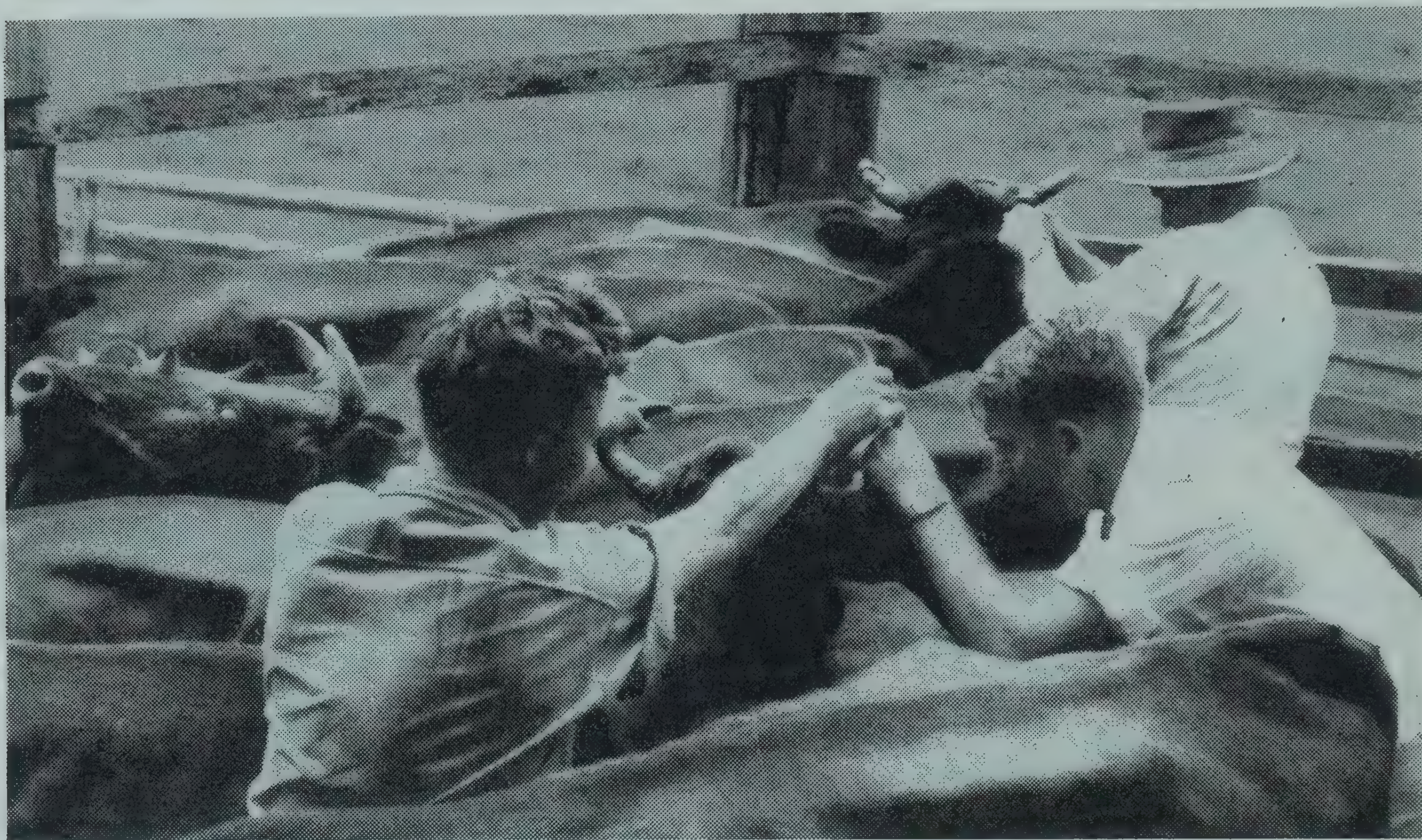
The cattle tick is a serious parasite of cattle. It causes severe irritation, resulting in loss of condition and, in dairy cattle, reduced milk production. The tick may also spread tick fever.



Thorough dipping is necessary to kill the cattle tick.

The Author: Mr. J. H. P. Dingle, Analyst, Board of Tick Control, Lismore.

In New South Wales the cattle tick is found only on the far north coast. Originally, it reached Australia on Brahman cattle imported to Darwin in 1872. From Darwin it spread to the areas of high rainfall of the Northern Territory, northern Western Australia, Queensland, and north-eastern New South Wales.



Cattle are carefully examined to see if they are carrying any ticks

Laboratory development

The Board of Tick Control Laboratory was set up at Casino in 1912, and moved to its present situation in Lismore in 1923.

The need for the laboratory arose when arsenical dips came to be used for killing cattle ticks. Arsenic in dips is subject to oxidation, which causes variation in the strength of the dip. Regular analyses of dip samples had to be made so that the correct arsenic strength could be maintained.

A further activity of the Laboratory was the analysis of speciments from cattle suspected of having died from arsenical poisoning as a result of dipping. Where stock died in this way compensation was paid to owners.

Chlorinated hydrocarbons

Owing to the development of cattle ticks resistant to arsenic, the chlorinated hydrocarbon insecticides DDT and BHC were introduced in 1952. These preparations gradually replaced arsenic throughout the tick-infested area.

Because of insecticide residues in carcasses exported from Australia, it was necessary to abandon chlorinated hydrocarbons. In 1960 they were replaced by organic phosphates. Seven different formulations of organic phosphates are now in use throughout the area. All are weakened during dipping, and regular analyses are necessary, as with arsenic, to maintain the correct strength. The organic phosphates are chemically different from each other, and require different methods of analysis.

There has been a continuous expansion of work carried out at the laboratory since its inception. The premises have had four separate additions. Staff has increased from a single analyst to four chemists, tour laboratory assistants, four assistants and an office assistant.

Research

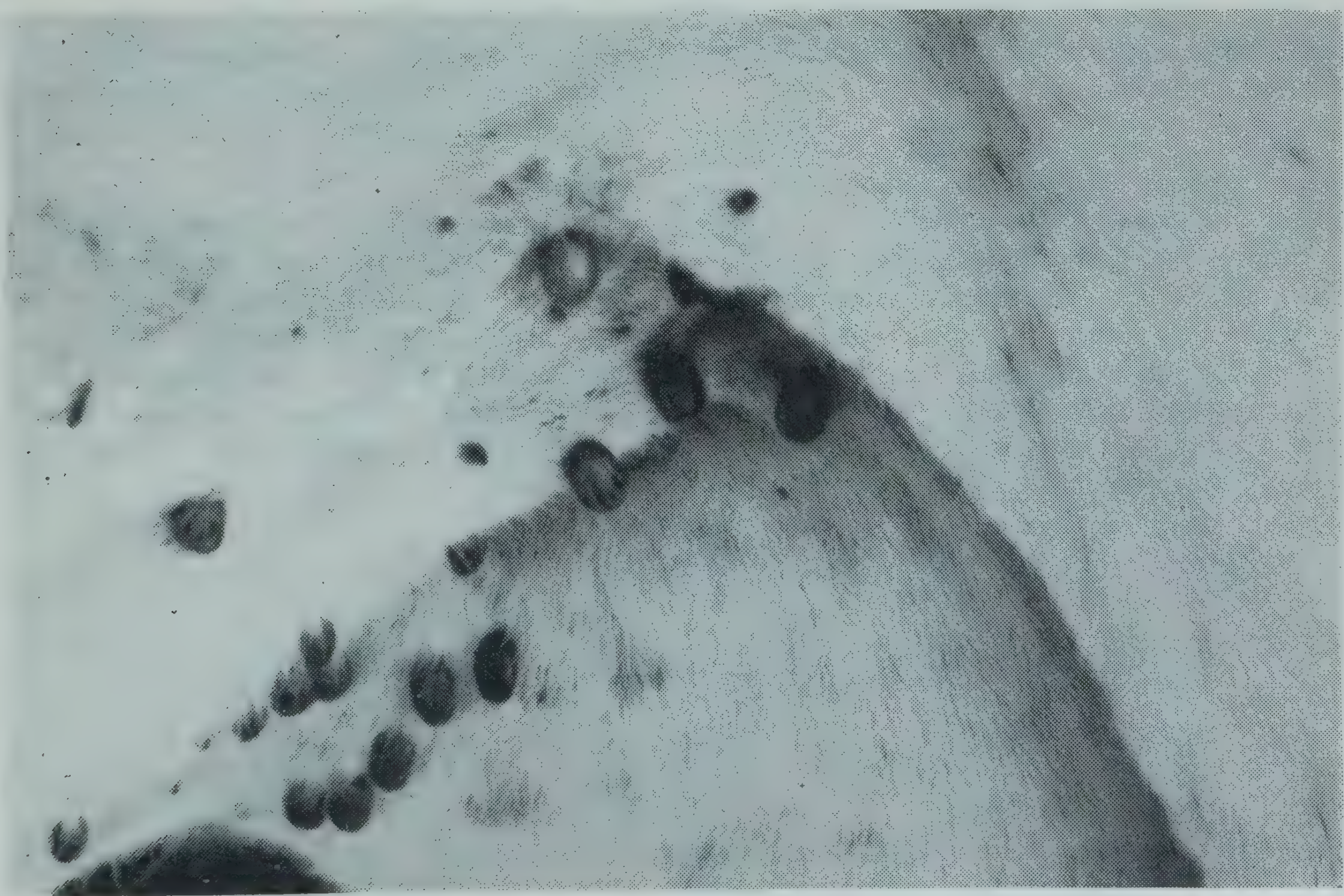
Oxidation of arsenic. Research as well as routine analyses, is undertaken. The first problem investigated was the oxidation of arsenic. Oxidation reduced the efficiency of dips. This could be overcome by increasing the concentration of arsenic. However, at times the oxidised arsenic would revert to the reduced form, thereby greatly increasing the toxicity of the mixture for cattle. It was found that cattle droppings caused the reversion of the oxidised arsenic. Manure was then added to dips to control oxidation. This was successful but was very objectionable as far as hygiene was concerned.

Later, separated milk was found to be effective but the milk putrefied in the dip. Subsequently the discovery was made that molasses would achieve the same result, without the disadvantages of the previously used additives. Molasses continued to be added to dips until the use of arsenic was discontinued.

Chlorinated hydrocarbons. The next major problem that confronted the Laboratory was associated with the use of DDT in dips. Being insoluble in water the formation of a homogenous dipping fluid posed difficulties. The problem was solved by melting the DDT formulation and immediately pouring it into the water in the dip. A colloidal suspension of DDT which partially became converted into crystals, then formed. These crystals adhered to the hair of cattle resulting in stripping of the suspension. Frequent replenishment of the DDT in the dip was therefore necessary.

Analyses of dip fluid to ensure maintenance of dip strength were required at frequent intervals. Special methods for sampling and sub-sampling for analysis had to be adopted.

Organic phosphates. When organic phosphates replaced chlorinated hydrocarbons, new analytical techniques had to be developed. The experience gained with DDT proved valuable as the new formulations were all insoluble in water. However the active ingredients in organic phosphate dips are used at a much lower level than either arsenic or DDT. Work with these



Ticks cause severe irritation, and can cause serious production losses

DDT formulations are heated before being poured into the dip

lower concentrations of insecticide called for greater analytical accuracy.

Insecticide residues. When the problem of chlorinated hydrocarbon residues in carcasses first arose, it was considered desirable to analyse fats and tissues of stock dipped in DDT and BHC. The minute concentrations of insecticide resident in such tissues necessitated special equipment, which was purchased at considerable cost. The use of the new apparatus enabled much work to be done on this problem, and valuable information was obtained. Analyses were subsequently performed on tissues of stock treated with organic phosphates.

Conclusion

The setting up of the Cattle Research Station in 1961 has further increased the importance of the Laboratory. In cattle tick research work numerous chemical analyses are involved, so that the staff of the Laboratory and of the Cattle Tick Research Station are continually collaborating. ●

Infectious Sinusitis

A COMMON DISEASE OF TURKEYS IN N.S.W.

Division of Animal Industry

INFECTIOUS SINUSITIS occurs only occasionally in New South Wales but is of considerable economic importance in infected flocks. It is characterised by inflammation of the lining membranes of the sinuses, which are just below the eyes. The sinuses become distended with a whitish semi-fluid exudate. The bronchial tubes, lungs and air sacs may also be affected.

Turkeys of all ages may develop the disease but birds of three to five months of age are the most susceptible. When birds a few weeks old are affected, mortality may be extremely high. In older birds the mortality is usually low but the economic loss can be considerable because of the retarded growth of infected birds.

The cause of sinusitis is *Mycoplasma gallisepticum*. This organism also causes chronic respiratory disease (mycoplasmosis) in chickens. The organism can be transmitted from chickens to turkeys.

Symptoms

Two forms of sinusitis are recognised. The sinus form is the one from which the disease derives its name. The other is the respiratory form which affects the lower respiratory tract. This form produces symptoms resembling chronic respiratory disease in chickens.

In the early stages, affected birds may shake their heads violently. On close examination, a clear nasal discharge may be seen. Discharges will also be found on the feathers of the wings where birds have attempted to clean their nostrils. Following these signs, the eye secretions become frothy and there develops a profuse, clear

discharge from the nostrils. Swelling of the sinuses, and in advanced cases, a partial to complete closing of the eyes are the principal symptoms that follow these early signs.

The appetite remains good as long as the bird can see to eat. As the disease progresses, affected birds lose weight. Occasionally the breathing becomes laboured because of involvement of the air sacs, windpipe or lungs, or blockage of the nasal passages by the swelling of the sinuses.

Course of the disease

Spontaneous recovery occurs occasionally but often the condition persists for months. Once the contents of a sinus becomes cheesy the disease continues indefinitely.

Infectious sinusitis mostly runs a chronic course and may exist in a flock for weeks or months. The number of deaths may be less than in some more acute diseases, but the financial loss may be greater, as affected birds fail to gain weight. Recovered birds can be carriers of the disease.

Post mortem findings

In most cases only the sinuses are involved. They are filled with exudate. There may also be inflammation, indicated by a darker than normal colour, of the lungs and wall lining the chest cavity. Occasionally the changes will be confined to the lower respiratory passages without involvement of the sinuses. Cheesy material in the air sacs is commonly found in acute outbreaks. If the lungs are affected, mucus is usually present in the bronchi.

In the early stages the exudate in the sinuses is watery but later it becomes yellowish and semi-fluid. Occasionally this exudate becomes cheesy and whitish-yellow in colour.

Distinction from other diseases

Sinusitis must be differentiated from:

- Fungus infection of the lungs;
- Sinusitis caused by foreign body penetration; and
- Sinusitis associated with vitamin A deficiency.

In fungus infections there is no involvement of the sinuses, and usually only a few birds are affected.

Sinusitis caused by a foreign body such as a grain of wheat usually affects one side only.

Turkeys require two to four times as much vitamin A in their ration as do fowls. This is normally supplied when adequate quantities of green feed are available. If green feed is absent or in short supply it is necessary to feed a vitamin A supplement. A suitable supplement is cod liver oil while commercial vitamin A preparations are also obtainable.

In newly hatched poults symptoms of the deficiency will appear in three to four weeks if no vitamin A is fed; the birds appear listless and walk unsteadily. The eyes show a watery or milky discharge which later becomes cheesy, collecting in the eyes and sinuses. Usually all the birds die within two weeks of the appearance of symptoms if no vitamin A is given. Similar symptoms are seen in older birds but the swelling of the sinuses is usually more pronounced.

In cases of vitamin A deficiency post-mortem examination reveals cheesy masses in the sinuses and small whitish pustules on the membranes of the mouth and gullet. These pustules do not occur in sinusitis. In young birds cheesy material may form in the anal bursa, a small sac found in the abdominal cavity attached to the end of the digestive tract. This occurrence is not a feature of sinusitis.

Treatment of sinusitis

Most affected birds respond to treatment with streptomycin, which is given by individual injection. When the sinuses are involved, a solution of 100 to 150 mgm. of streptomycin dissolved in 0.5 to 1 cc. of sterile water is injected into the cavity of each affected sinus. This usually results in recovery within 7 to 14 days.

Where the lower respiratory tract is affected the injection of streptomycin is best made into the dewlap. The quantity of streptomycin to be injected is 250 mgm. for a bird of 5 lb., and proportionately less for

smaller poults. This dose must not be exceeded. Turkeys are susceptible to the action of streptomycin which is likely to cause deaths from shock. In fact it is a good plan to treat a few affected birds first and keep them under observation for several hours before injecting the rest of the birds showing symptoms.

Instead of streptomycin, tylosin tartrate (Tylan ®) may be used on turkeys with infected sinuses. The injection is made into the sinuses in the same manner as with streptomycin. The drug is injected at the rate of 6 mgm. in $\frac{1}{4}$ cc. boiled water per sinus for birds under 10 lb. and 12 mgm. per sinus for larger birds. Birds still affected after 10 days should be retreated.

Tylosin tartrate should not be used on turkeys producing eggs for human consumption, nor within eight days of slaughter for food.

As a further alternative, $\frac{1}{2}$ to 1 c.c. of a suspension containing 100 mgm. of furazolidone per c.c. may be injected into each affected sinus. This treatment is said to be highly efficient.

Prior to the advent of antibiotics, silver nitrate was used for treatment. The purulent material in the sinus was withdrawn by means of a syringe and needle. Then, 1 cc. of a 4 per cent silver nitrate solution was injected into the cavity with another syringe through the same needle.

® registered trade name.

Prevention and control

Turkeys that recover from sinusitis are usually immune to further attacks. However, they may remain carriers for some time and transmit infection to other birds. For this reason recovered birds should be segregated from growing poults. Because of the close relationship between this disease and chronic respiratory disease in chickens it is advisable to keep turkeys separate from poultry.

Sinusitis can be transmitted from turkey hens to their progeny by way of the egg. It is therefore inadvisable to breed from turkeys that have recovered from this disease. In the case of bad outbreaks it is probably best to dispose of the entire breeding flock.

There is a blood test for the detection of infected and carrier birds. Although not detecting all carriers of the disease it is a very useful test. When introducing birds it is advisable as far as possible to make purchases from flocks in which breeders have been tested without the occurrence of positive reactors. •

RESEARCH SECTION

RESEARCH PARS

PAPER

The Cattle Tick Research Station

THE UNITED STATES OF AMERICA eradicated cattle tick from 15 States with a total area of 750,000 square miles between 1906 and 1943. A large and expensive campaign to eradicate cattle tick from an area of 2,500 square miles in north-eastern New South Wales in 1956-7 failed, although the same methods and better materials were used. A committee of inquiry* recommended local research before any further attempt to eradicate was undertaken.

In 1961 the Cattle Tick Research Station was established at Wollongbar, near Lismore, with Dr. R. N. McCulloch as Director. Dr. McCulloch was previously Principal of Roseworthy Agricultural College in South Australia and earlier had been an entomologist in the New South Wales Department of Agriculture. His Doctorate of Agricultural Science was awarded for research on the control of scrub typhus mites during the war.

The Station has developed rapidly. The Commonwealth Government has helped finance costly facilities needed for studies of the cattle tick and tick control. For example, there are 32 tick-proof stalls where every tick falling from an animal can be collected. In building and equipping the Station, advantage was taken of the experience of the Queensland Department of Primary Industries and the C.S.I.R.O.

Three aspects of the cattle tick problem are being studied—the life history of the tick, tick fever, and dipping and spraying cattle for tick control.

The life history studies have been particularly aimed at an understanding of the duration and effect of environment on the non-parasitic stage of the tick. When the work commenced, the period that ticks could survive in New South Wales without feeding on cattle was not precisely known and there was little objective evidence about the ability of young ticks to hatch or survive on the ground through a winter. This part of the research work could explain, or eliminate some possible explanations for, the failure of the 1956-7 eradication campaign.

Tick fever is not a major disease in New South Wales. It occurs in Queensland wherever ticks occur but attempts to keep it out of this State have been fairly successful. There have been 330 outbreaks since 1916, but most of them have involved fewer than 5 head of cattle. There was a more serious outbreak at Cougal in 1964. The tick fever work at Wollongbar is mainly directed at the use of new methods of finding the cattle that carry the disease and that are probably the source of the occasional outbreaks.

Dipping materials are being tested in the dipping and spraying studies. In an eradication

* MACKERRAS, I. M., and others (1961) *The Cattle Tick Problem in New South Wales*, Science Bulletin 78, N.S.W. Department of Agriculture.

campaign it would be desirable to have at least two effective dipping materials: the campaign would be commenced with one and if resistance developed another would be substituted. DDT was used in the 1956-7 eradication campaign. In some places, including Queensland, ticks have developed resistance to DDT but no DDT resistant ticks were found in New South Wales after the campaign failed. Although the effectiveness of DDT against ticks was not doubted, the Department of Agriculture ceased to use it and related chemicals in 1962 because of the occurrence of residues in meat and milk products.

Testing a dipping fluid includes studies of survival of ticks on the dipped cattle, whether ticks dropped by dipped cattle can reproduce, whether the material is picked up reasonably evenly in cattle hair, what period of protection is afforded against tick larvae seeking to attach to the beast, whether the chemical is affected by age or dirt or organic matter in the bath, and potential dangers to cattle and dipping operators. Several of the newer dipping fluids tested have been shown to have advantages over DDT besides freedom from residue problems. ●

Soil Surveys

THE FOURTH REPORT of the Soil Survey Unit of the Department, *Report on Dune Soils in the Barham District of New South Wales*, by A. M. H. Riddler, has been published. The report will be of interest to farmers in the Barham area, extension officers in the south-west, and research workers concerned with soils. Copies are available from the offices of the Department in the South-Western Region and from the Chief Chemist.

A reconnaissance soil survey of the mid-Clarence Valley, covering an area of 2,500 square miles, is almost completed and initial field work on a similar area in the Upper Clarence has been initiated. Aerial photographic interpretation and analysis has been employed in these soil surveys to allow large areas to be covered quickly and also to emphasise the part that the landscape plays with rock type in the development and location of soils and also assessment of potential land use.

Completed surveys of saline soils at Richmond and of an area around Rylstone are being prepared for publication. ●

Antibiotics and Mastitis

MASTITIS is one of the most important diseases of dairy cows and causes far greater financial loss than is realised. A recent estimate puts the loss to the Australian dairy farmer at more than £10 million annually.

The causes of mastitis, both clinical and sub-clinical, are many, and control measures are complicated owing to the insidious nature of the disease. The incidence can be reduced by scrupulous attention to hygiene in the milking procedure and by the maintenance of maximum efficiency in the milking machine. Complete eradication of the pathogenic bacteria responsible for the disease can be achieved sometimes by the correct use of antibiotics.

The introduction of penicillin for mastitis therapy in the late 1940's, followed by other antibiotics effective against a wider range of pathogenic bacteria, appeared to be the solution to the mastitis problem. The early promise of these agents has not been realised fully, and while they are effective in many cases, the incidence of mastitis appears as great now as it was when antibiotics were first introduced. This is because of a change in the types of bacteria causing the disease brought about by the use of penicillin. Instead of streptococci, particularly *Streptococcus agalactiae*, which are susceptible usually to penicillin, there is now a greater proportion of cases caused by staphylococci which are frequently resistant to penicillin.

A new group of antibacterial agents, the nitrofurans, has recently been developed and shows promise of greater effec-

tiveness against bacteria causing mastitis. One compound, a mixture of two nitrofurans, nitrofurazone and furazolidine, is being marketed in Australia. It is claimed that the nitrofurans are effective against more types of bacteria than earlier antibiotics, and that they are completely excreted from the udder in 24 hours. The rate of excretion is important because it could decrease the time between treatment and the milk being suitable to market.

Dr. R. J. Richards of the Bacteriology Section of the Biology Branch is determining the effect of the nitrofuran compounds on the acid-producing ability of cheese starter cultures. The inhibition of acid production by antibiotics is one of the main causes of failure in cultured products manufacture. These products include cheese, cottage cheese, yoghurt and sour cream. In co-operation with officers in the Division of Dairying, and with the assistance of a drug manufacturer, he is also investigating the relative effectiveness of penicillin, streptomycin, tetracyclines and the nitrofurans in controlling the bacteria that cause mastitis in dairy herds. ●

Macadamia Propagation

DIFFICULTIES IN PROPAGATION have impeded development of the macadamia nut industry in New South Wales. (See *Agricultural Gazette*, September, 1964, p. 1290.) In an attempt to overcome the problem, D. S. Leigh has compared grafting techniques and investigated factors suspected of being critical in propagation of macadamia in the shade-house at the Tropical Fruit Research Station, Alstonville. His trials and observations are indicating the requirements for successful grafting.

The most suitable periods of the year for grafting macadamia have been late autumn (April-May) and early spring (August-September). The cold mid-winter and the hot summer periods are to be avoided.

Bark grafts have proved superior to side grafts under all conditions at Alstonville. Health, vigour and stage of growth of both the stock and scion are important in obtaining successful grafts. The most suitable stocks have been vigorous, in an early flush stage of growth, and from one-half to two-thirds of an inch in diameter. Mature, vigorous scion wood, cinctured on the parent tree four to six weeks before use, has given best results. Scions with diameters about half as large as the stocks to be grafted were used.

In the case of *Macadamia tetraphylla,* Mr. Leigh prefers grafting wood that has defoliated naturally. This factor does not seem so important with *Macadamia integrifolia* as results have been satisfactory with this species when leaves were trimmed to a short petiole at the time of cutting the scion wood.

It has been found that scions having two bud whorls are best. To ensure that large areas of cambium will be in contact, scion wood with a long internode should be selected so that the sloping cut made in preparing for insertion into the stock can be at least 1½ inches long.

Tying grafts with plastic tape and the use of a suitable mastic for holding the graft in firm contact and completing the seal are essential. Macadamia forms callous tissue very slowly under natural conditions in New South Wales. As a result the scion may dry before union between stock and scion can occur. It has been found that covering the graft and scion with a sleeve of plastic film reduces drying out and increases the chance of success.

The root system of the macadamia consists of bunches of lateral rootlets forming mats just below the soil surface. Consequently, plants are sensitive to soil-moisture fluctuations, particularly in the seedling stage, and it is essential to maintain water supply. Heavy losses can occur in the nursery or shade-house with potted or open grown stocks if the soil becomes too dry.

Very encouraging results have been obtained in the shade-house at Alstonville using the methods Mr. Leigh describes. So far results of propagations in the open have been inconsistent in all trials. ●

Fluorine in Underground and Surface Waters in New South Wales

M. G. CHATFIELD

Analyses carried out over a number of years indicate that, except in very few instances, the level of fluorine in surface and underground waters in New South Wales is not a hazard to the health of livestock. This report presents the results of analyses for fluorine by the Division of Science Services of the Department between 1947 and 1961.

THE FLUORINE CONTENT of surface and underground waters used for stock watering in Australia has been studied by a number of authorities.

Published data for Queensland (Harvey 1952, 1953*a*, 1953*b*) record levels of fluorine detrimental to sheep in thermal bicarbonate waters particularly in the Gulf area and southwards to Cloncurry, Longreach and Barcaldine. In South Australia, Ward (1952) reported highest concentrations, averaging 4.1 parts per million fluorine, in the carbonated bore waters of the Great Artesian Basin in the north-east of the State.

In New South Wales, the incidence of fluorine in domestic waters from 55 towns has been studied by Jones (1949), principally in relation to dental caries in humans. In 1947 the Department of Agriculture commenced its analytical survey of the fluorine content of surface and underground waters received from field officers of the Water Conservation and Irrigation Commission of New South Wales and from landholders.

From 1947 to 1961 a total of 1,844 samples from rivers, creeks, dams, bores, wells and springs were examined and data relative to their fluorine content are presented in the accompanying table and map.

Results of the survey

It is the practice of the Department to index samples received under the landholder's

The Author: *Mr. M. G. Chatfield, Division of Science Services, Department of Agriculture, Rydalmere.*

Fluorine content of bore waters in major sampling areas

Town	Number of Specimens	Fluorine p.p.m.		Specimens in groups (p.p.m.)			
		Lowest	Highest	Nil-0·5	0·6-1·0	1·1-2·0	Above 2·0
Baradine	11	0·15	2·4	5	3	1	2
Boggabri	12	Nil	0·6	11	1	..	..
Bourke	103	Nil	3·0	51	29	18	5
Canowindra	17	Nil	1·6	14	1	2	..
Collie	13	0·1	1·8	7	4	2	..
Coonamble	60	0·1	4·0	23	16	18	3
Dandaloo	13	0·15	1·9	7	4	2	..
Denman	26	Nil	1·0	21	5	..	..
Dubbo	52	Nil	3·4	48	3	..	1
Forbes	17	0·05	1·2	14	2	1	..
Gilgandra	21	0·1	2·0	6	10	5	..
Gulargambone	22	0·05	2·0	8	5	9	..
Gunnedah	11	Nil	0·6	10	1	..	..
Inverell	10	Nil	0·2	10	..	..	..
Narrabri	13	Nil	1·0	11	2	..	..
Narromine	79	Nil	1·4	69	7	3	..
Quambone	18	0·2	2·1	2	10	5	1
Tamworth	22	0·05	1·4	14	7	1	..
Trangie	32	0·1	0·9	17	15	..	..
Walgett	10	0·4	1·8	1	5	4	..
Wanaaring	18	0·4	3·0	6	7	1	4
Warren	38	0·3	3·7	9	19	9	1
Wilcannia	8	0·9	9·0	..	1	2	5


MAP
OF
NEW SOUTH WALES
SHOWING
FLUORINE IN UNDERGROUND
WATERS : PARTS PER MILLION
SCALE
Mls. 32 24 16 8 0 32 64 96 128 Mls.
LEGEND
NUMBER OF OBSERVATIONS MADE, SHEWN THUS, e.g. :- 4
CONTENT : NIL TO 0.5 p.p.m. :-
CONTENT : 0.6 TO 1.0 p.p.m. :-
CONTENT : 1.1 TO 2.0 p.p.m. :-
CONTENT : ABOVE 2.0 p.p.m. :-
QUEENSLAND
SOUTH AUSTRALIA
VICTORIA
SYDNEY
CANBERRA
NEWCASTLE
MURWILLUMBAH
LISMORE
GRAFTON
KEMPSEY
TAREE
ARMIDALE
INVERELL
DELUNGRA
WARIALDA
MOREE
BELLATA
NARRABRI
BOGGABRI
GUNNEDAH
MANILLA
TAMWORTH
CURRABUBULA
QUIRINDI
SCONE
DENMAN
SINGLETON
GOSFORD
PENRITH
PICTON
THIRLMERE
BERRY
GOULBURN
MORUYA
COOMA
CURLEWIS
CASSILIS
MUDGEE
RYLSTONE
BURREN JUNCTION
WEE WAA
BARADINE
COONAMBLE
GULARGAMBONE
GILGANDRA
WELLINGTON
DUBBO
DRIPSTONE
WALGETT
CARINDA
CASTLEREAGH
TRANGIE
NARROMINE
COLLIE
WARREN
QUAMBONE
MACQUARIE
DANDALOO
NYNGAN
GIRILAMBONE
COBAR
BOGAN
CONDOBOLIN
GUNNINGBLAND
FORBES
EUGOWRA
CANOWINDRA
COWRA
YOUNG
HARDEN
BRAWLIN
COOTAMUNDRA
QUANDIALLA
TARCUTTA
NARRANDERA
WAGGA WAGGA
BROCKLESBY
HILLSTON
TRIDA
LACHLAN
MURRUMBIDGEE
MURRAY
BALRANALD
WENTWORTH
BOURKE
LOUTH
ENNGONIA
FORD'S BRIDGE
WANAARING
HUNGERFORD
WILCANNIA
DARLING
BROKEN HILL
TIBOOBURRA
MILPARINKA
GWYDIR
NAMOI
GREAT ARTESIAN BASIN
BOUNDARY OF

name and postal address. Consequently the table and map refer to the postal towns from which samples were received. The circular notation used in the map should therefore be read as representing the town shown and its environs. The numeral in the inner circle refers to the number of samples examined from the area, and the annular space has been segmented to indicate the proportion of samples in each fluorine group to the total.

The table gives data for the major sampling sites and represents 626 specimens of the total 1,844 in the survey. The remaining samples have been listed alphabetically as to source and location and complete lists are available on application to the Chief Chemist, Department of Agriculture, Rydalmere, New South Wales.

A study of the map indicates a preponderance of low fluorine waters especially in the eastern seaboard sections of the State. Within the Great Artesian Basin area concentrations of below 1.0 p.p.m. fluorine predominated, the highest was 4.0 p.p.m. for a bore at Coonamble. Other high recordings in this area were: Warren 3.7 p.p.m.; Dubbo 3.4; Baradine 2.4; and Quambone 2.1 p.p.m.

At Wilcannia, on the Darling River, figures for bore waters ranged from 9.0 p.p.m. through 8.0, 4.0 and 3.8 to a low of 0.9 p.p.m. fluorine. This area showed the highest figures for the State. Wanaaring, also in the Western Division, had bores with 0.4-3.0 p.p.m. Wentworth on the lower Murray showed one bore with 2.8 p.p.m.; the other six samples from this area were wells with a maximum of 0.3 p.p.m. fluorine.

Delungra in the north-west showed two bores with 2.8 and 3.8 p.p.m. whereas Warialda and Inverell on either side of it showed less than 0.5 p.p.m. fluorine in 14 bore water samples tested.

Analytical procedures

The method used was basically that of Sanchis (1936). Steam distillation for the isolation of fluorine from interfering substances was employed on occasions especially with discoloured waters where the colour of the water interfered with the matching of the Alizarin Red/Zirconium Oxychloride reagent colour standards. Dilution techniques were frequently employed to minimise the effect of interfering substances such as sulphates. It is considered that the methods allow of accurate colour matching to 0.05 p.p.m. fluorine against prepared standards.

Acknowledgements

Acknowledgement is made of the participation in the analytical work of both past and present members of the Chemistry Branch, Division of Science Services.

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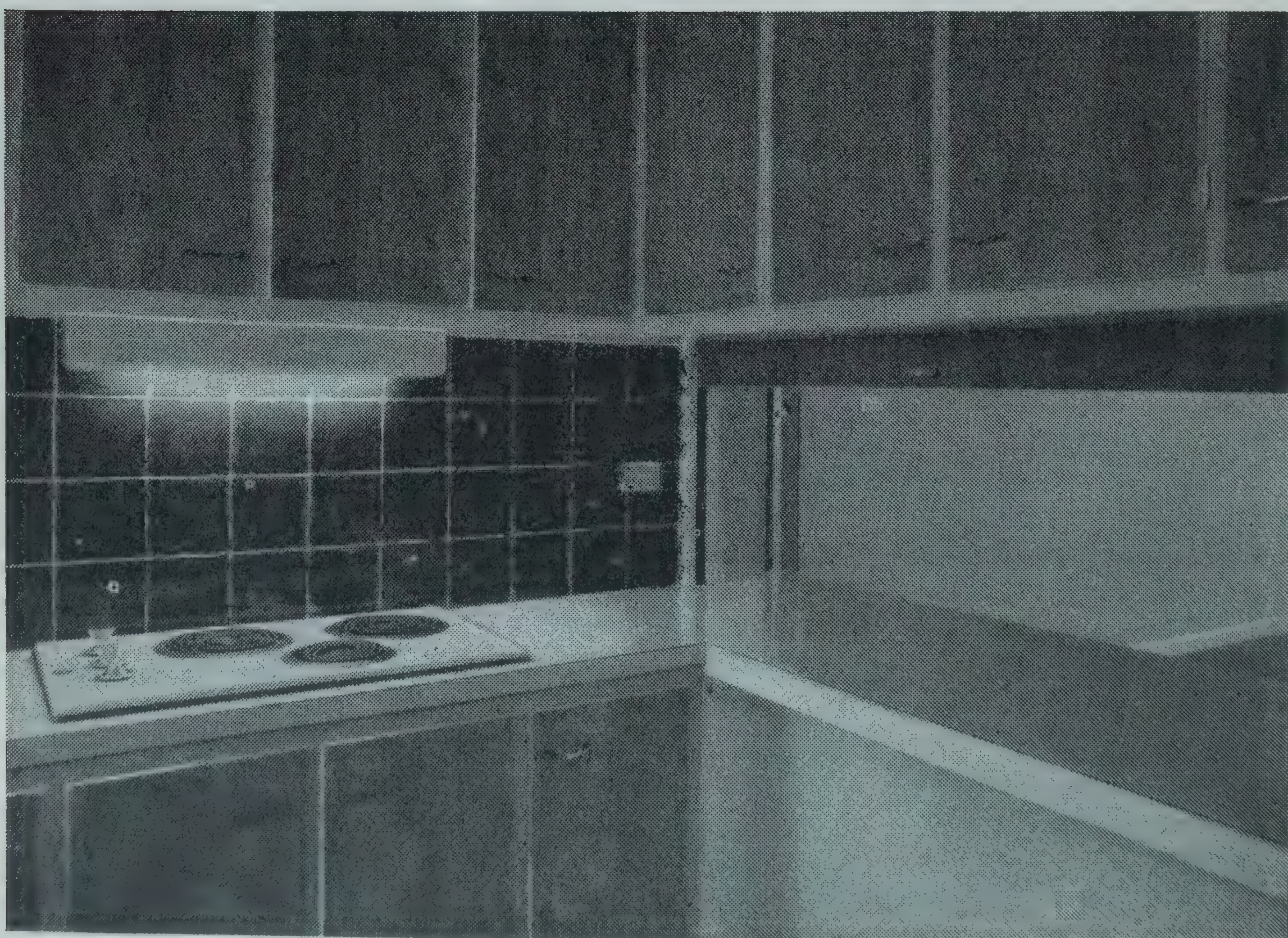
Localize Domestic Lighting

Adapted from "I.E.S. Lighting Review", 1st June, 1963. Photos by courtesy of the Sydney County Council.

A GOOD LIGHTING SCHEME is essential in a modern home. It comprises light for decorative accent, light to enhance the beauty of planned interiors, and good general lighting. Equally important it provides light to help with the many everyday household tasks.

Reading and writing, food preparation, washing and ironing, sewing and knitting, make-up and grooming, all require the

Figure 1. A shielded, 20-watt fluorescent lighting unit over hotplates makes cooking easier.



assistance of good lighting. If they are performed with inadequate light, the eyes fatigue quickly because they strive to see details which are not clearly revealed.

Good quality light for a particular task may be defined as the light which has sufficient intensity and softness to provide easy, comfortable seeing of all necessary detail and movement required to perform that task. Soft, diffused light, without direct or reflected glare, would be suitable for most domestic tasks. It is important to provide good general or background lighting surrounding the working area because excessive brightness between the tasks and its surroundings will cause eye fatigue.

Portable lamps are ideal for providing quality light where it is needed. However, fixed lighting fittings are best in such locations as at bathroom mirrors and over kitchen food preparation benches. Figure 1 shows fixed lighting over the kitchen hotplate cooking unit.

Lounge chair reading

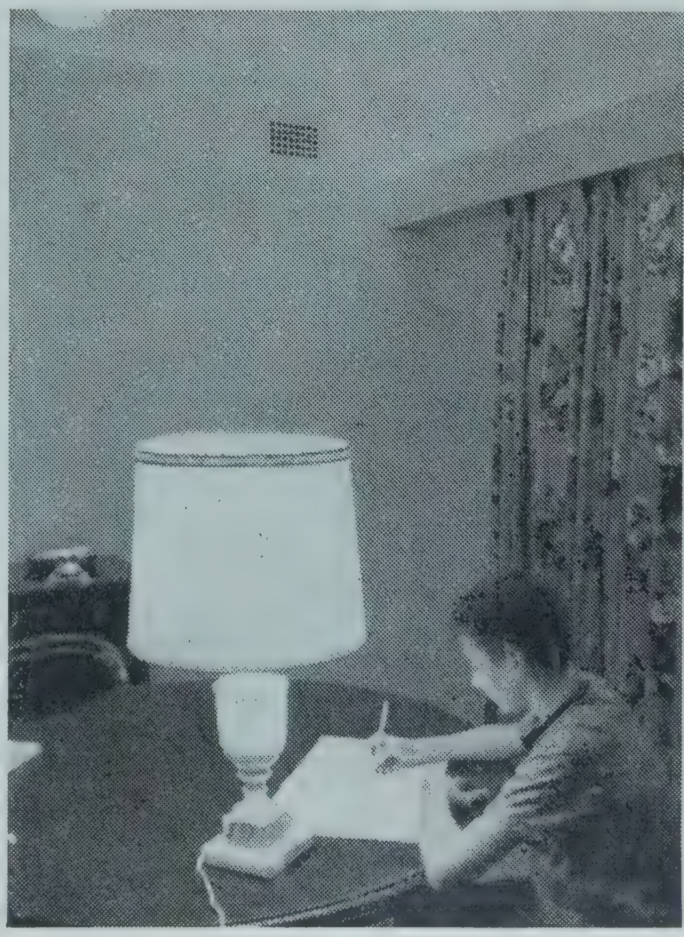
Light for reading while seated in a lounge chair can be effectively provided from a floor standard or a nearby table lamp. Standard lamps should be placed approximately 10 inches behind the shoulder in line with either corner of the chair. The underside of the shade should be approximately 4 ft. from floor level.

Figure 2 shows a correctly placed floor standard lamp.

A table reading lamp adjacent to a seated person in a lounge chair should have the underside of the shade at eye level. The centre of the lamp should be in line with

Figure 2. Floor standard lamp has metal shades over 100-watt lamps.

Figure 3. Writing with a well-placed table lamp to provide soft light from 100-watt lamp, diffusing bowl and shade.



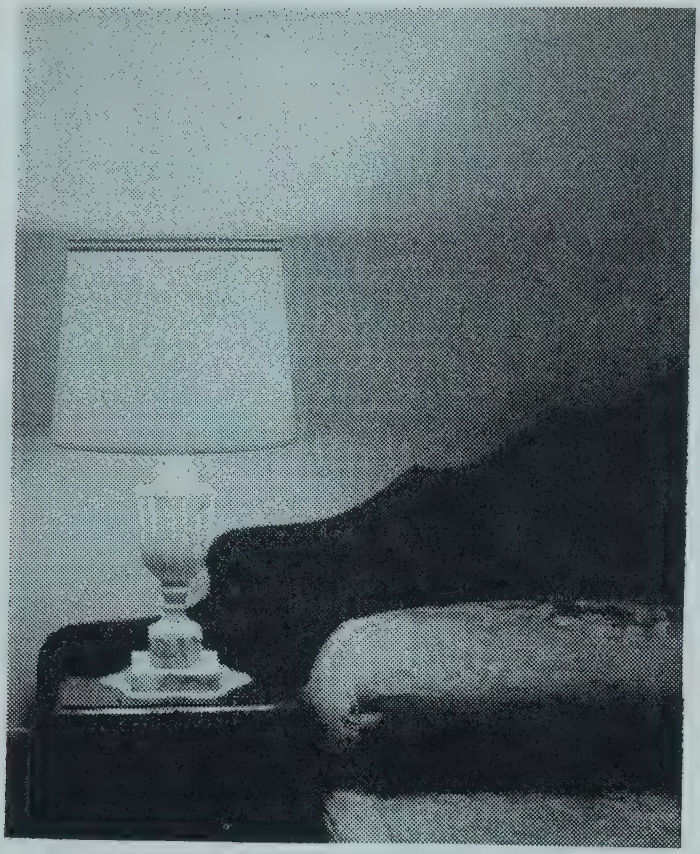
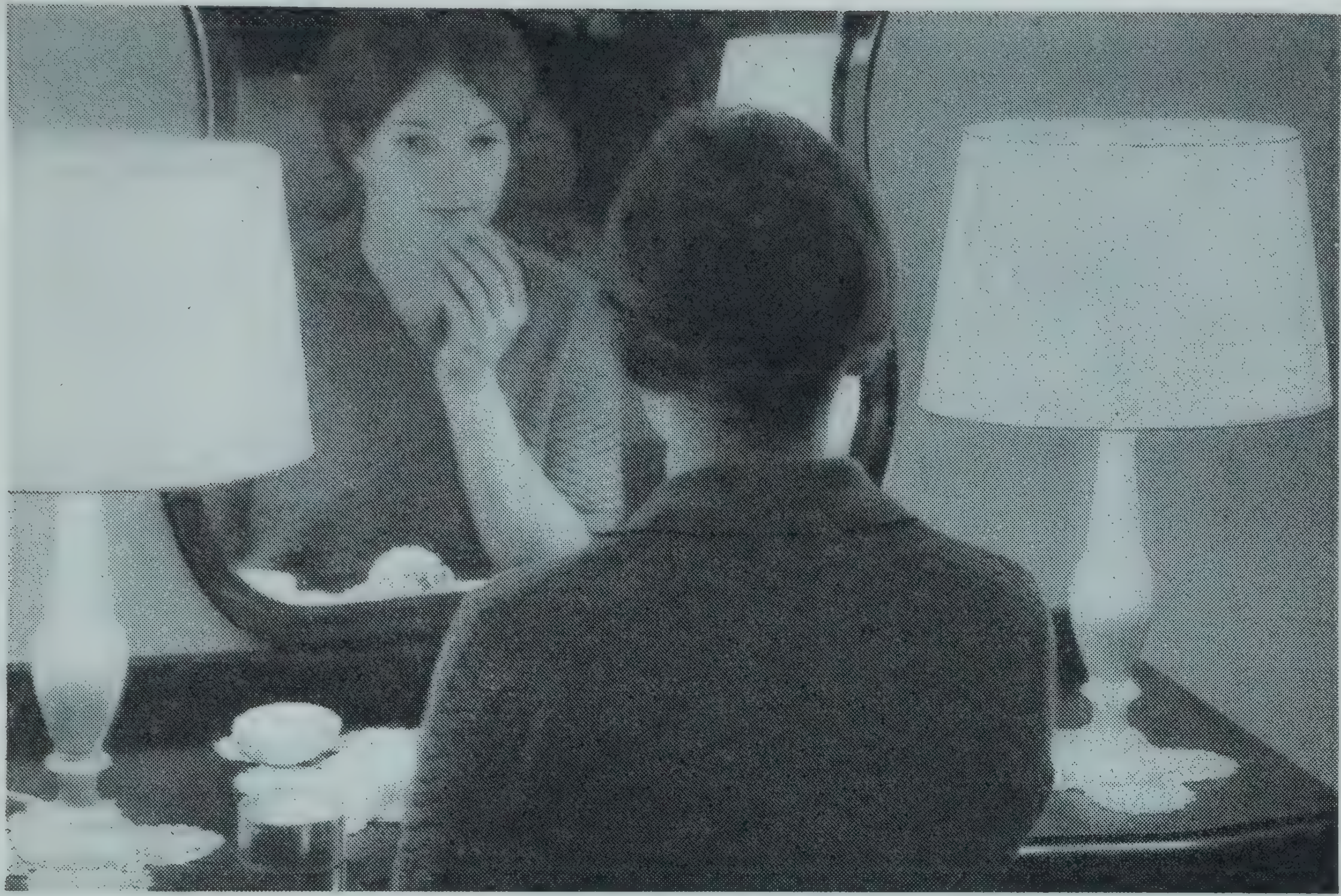


Figure 4. Typical bedside lamp giving adequate soft light for reading in bed.

Figure 6. Dressing table lamps give good light on face; 60-watt lamps are used without diffusers.

Figure 5. Lamp for sewing by machine has 20-watt fluorescent lamp 7 inches behind needle; bottom of shade is below eye level.



the shoulder, about 20 in. to the left or right of the reading material.

Reading and writing at table or desk

The eye-level should be approximately the same level as the underside of the shade. The lamp should be so positioned that its centre is 12 in. forward of the eyes and 15 in. to the left of the work centre for a right-handed person or 15 in. to the right of the work centre for a left-handed person.

Figure 3 shows a table lamp used for writing and studying.

For reading in bed

A bed reading lamp should have all the desirable characteristics of any good reading lamp. Satisfactory results are achieved by placing an overhead wall-mounted light at least 30 in. above the mattress level, or a bedside lamp 22 in. to the side of the reading material with the underside of the shade 20 in. above the mattress level. (See figure 4.)

Machine sewing

Wall lamps or swing arm floor standard lamps provide good light without obstructing the sewing operation if the lamp is 12 in. to the left and 7 in. behind the needle. The underside of the shade should be just below eye level, which is usually approximately 14 in. above the working plane, as illustrated in figure 5.

Alternatively, an adjustable fluorescent lamp is quite satisfactory.

Suitable light for sewing by hand can be obtained with a table reading lamp.

Make-up, shaving

Ideal lighting for make-up, or shaving, can be produced by two dressing table lamps placed approximately 36 in. apart with the centre of the shades slightly below face level. These effects are shown in figure 6.

Ironing

The two-light standard lamp, as shown in figure 7, provides adequate light for ironing. With this type of fitting it is important to have wide, deep, metal shades to spread the light around and over the entire surface of the ironing table.

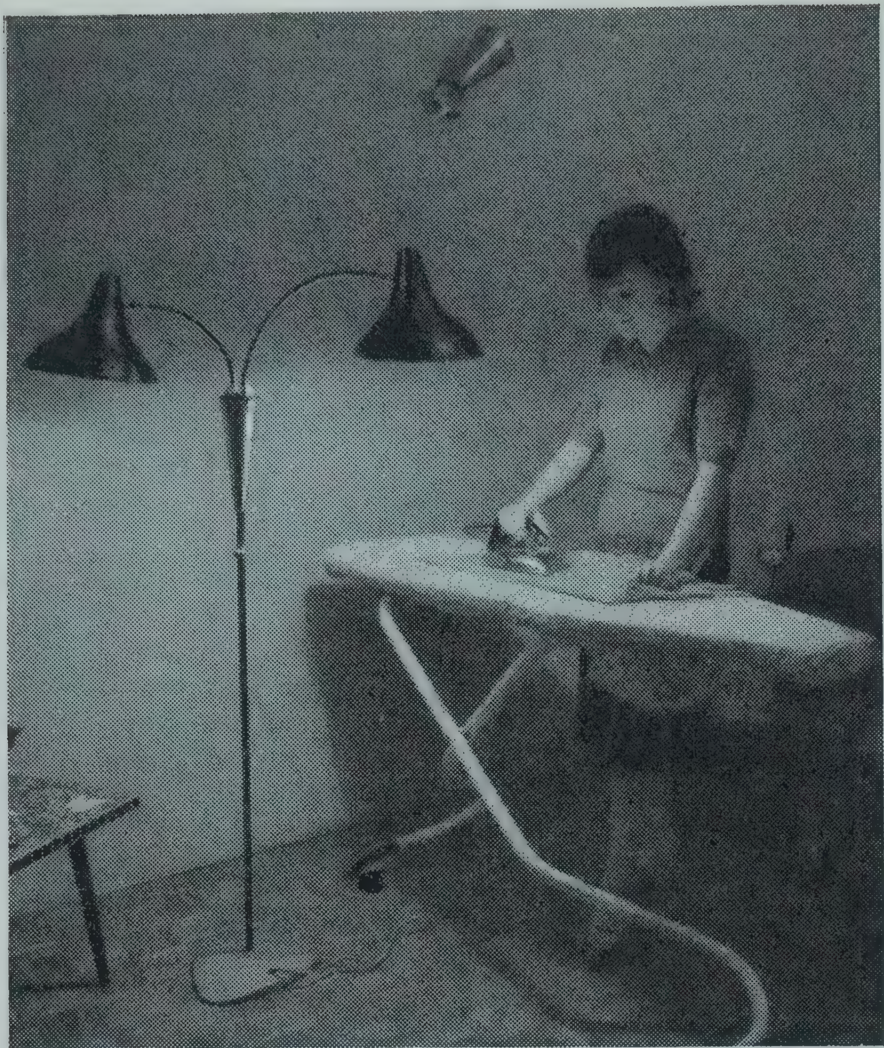


Figure 7. Twin adjustable standard with 100-watt lamps provides good light on and around the ironing board.

Portable lamp components

Floor standard, table or bedside reading lamps have essentially the same basic construction—a base or pedestal supporting the lamp, diffuser and shade.

Lamps should be of sufficient wattage (lumen output) to produce the satisfactory lighting intensity on the task. The diffuser produces the soft quality light and the shade controls and directs the light.

Floor standard lamp shades should be at least 16 to 18 in. diameter and table lamps at least 16 in. in diameter at the base. This is so that the spread of light under the shade will satisfactorily cover the surface of a book or magazine. Dressing table lamp shades may be much smaller, as generally these lamps have no diffusing bowl. The shade is translucent and of such texture to provide soft, diffuse light on the face.

The shade depth may vary but should always be sufficient to protect the eyes of a standing person from looking directly into the top of the shade at the lamp.

Shades should not be too narrow at the top, as the heat generated by the light source, and trapped in a narrow top, hastens deterioration of shade material. Also, the brightness difference between the down-lighted area and the darker area above is annoying and unattractive. Because this condition is a tiring one, there should be some provision for upward lighting to reduce large brightness differences throughout the field of view.

To contribute to lighting effectiveness, the shade should have a good white or near white inner surface so as to diffuse and reflect the light that falls upon it. This reflected and redirected light contributes to the amount and spread of light on the object to be seen. If the shade is translucent it should have sufficient density to transmit light without revealing the exact location of the light source as a bright spot. ●

COFFEE BREAK

COFFEE WAS FIRST USED as a medicine, then as an infusion at Mohammedan religious ceremonies. Later it became a favourite beverage in all Mohammedan countries and gradually the use of coffee became world wide.

Arabians are credited with the first use of coffee as a medicine. A famous Arabian physician known as El Razi wrote of the properties of coffee about 900 A.D. One of his books, the first known to mention coffee, contained a list of all then known drugs and their uses.

Coffee was miraculously revealed to the faithful in a part of Araby, according to Mohammedan tradition, and a number of legends relate that Mohammedan priests were the first to find uses for coffee.

One legend describes how an Arab herder complained that his goats, grazing on rich pastures near a Mohammedan monastery, frequently remained awake all night, and frisky.

Investigating, the prior found that shrubs bearing red and green berries bordered the pasture. The herder said his flock fed upon these shrubs; that when he ate the "coloured nuts" he too remained wakeful.

Returning to the monastery, the prior boiled some of the berries in water and drank the infusion. To his delight he found that it counteracted drowsiness and had no after effects, so he began to use coffee to keep the monks awake at their evening prayers.

There could be some truth in this legend because probably the first preparation of coffee was by infusion. This would surely be unpalatable and acceptable only as a medicine. Coffee as we know it today—tasty and aromatic—is ground from dried and roasted beans.

The first use of coffee in beverage form is attributed also to Mohammendan monks, almost five hundred years after being described by El Razi. This order of monks had come to Cairo from Yemen towards the end of the fifteenth century.

Steaming hot and ready to serve, coffee was brought in during their devotions at the mosque. It was poured into a great eathenware bowl from which the prior would solemnly fill a small bowl for each monk in turn as the chanting continued.

In time coffee drinking became part of the ceremony and later again it became customary to share it with the laymen who came to join them at prayer.

Coffee has had opposition since almost the beginning of its popularity. There is record of the prohibition of coffee in Mecca as far back as 1511.

The Governor of Mecca, disturbed by reports of coffee drinking in the temples, came upon a group of idlers drinking this popular brew in a temple ante-chamber. He had his soldiers eject them, and after this he ordered all places serving coffee to be closed and all stocks of coffee seized.

Coffee drinking by this time had become a part of religious observance in Cairo. When the Governor reported his action to his ruler in that city he was promptly told to lift the ban and return all confiscated stocks.

In 1674 a similar prohibition was made in England by Charles II for suppression of coffee houses . . . "resorts for idle and disaffected persons, where tradesmen waste their time instead of working". This measure was so unpopular that the proclamation was withdrawn.

Coffea arabica makes up the bulk of coffee used throughout the world and is believed to have come originally from Yemen or Abyssinia. As the use of coffee became world wide during the seventeenth century, Yemen was practically the only country with the raw product available for export.

A law was made in Arabia to prevent the export of viable seeds and protect its chief product from outside competition, but this law was easily evaded. Thousands of pilgrims journeyed from India to Mecca each year and seeds could be obtained and easily concealed in a traveller's clothing.

In 1640, according to Indian tradition, a pilgrim named Baba Budan smuggled some viable seeds to his home in Mysore. They flourished in his gardens and when the British commenced planting coffee in India in 1840 there were large areas already under cultivation. These plantations were said to have come from the seeds smuggled in by the pilgrim two hundred years earlier.

The great West Indies coffee plantations were started by a young and patriotic French officer named Gabriel Mathieu de Clieu. With great difficulty he obtained permission for the release of a single coffee plant from the *Jardin des Plantes* in Paris.

He nurtured it across the Atlantic despite pirates and violent storms: The ship's fresh water supply ran low and he used his own precious ration to keep the plant alive. He endured these remarkable hardships because he was convinced that only coffee could help Martinique towards economic independence.

The coffee habit spread throughout Europe during the sixteenth and seventeenth centuries, but coffee houses originated in the East. London's first coffee houses were established in the 1650's and rapidly became meeting places for the intelligentsia, who forsook the taverns of the day for the new "cafes".

These coffee houses became centres for political and literary conversation and for the circulation of news, and were forerunners of the great clubs.

Lloyd's of London, world renowned as insurance underwriters and specialists in marine insurance, came from these simple beginnings. It was originally a small coffee house where London's principal merchants and shipowners used to meet.

The first licence to sell coffee in North America was issued in Boston in 1670. On the Continent coffee houses flourished from the seventeenth century, particularly in France, Holland, and Germany.

By the end of the eighteenth century coffee plantations had been established all over the world. World consumption today has reached a total of some 4,000,000 metric tons per year, with an ever-increasing demand. ●

A PLACE FOR CONIFERS IN YOUR GARDEN

M. WATSON

CONIFERS are known to many as pines, although correctly this last name refers only to one family in a very large group.

People who look to flowering plants for masses of coloured blooms will not find much beauty in conifers. However, for those who can appreciate beauty of form, colour and texture of foliage, the grandeur of large trees, and the quaintness of the miniature forms, this group will provide unending scope.

Conifers may be used for many purposes in both large and small gardens. It has been a common mistake in many cases to misuse this group and to bring many of its fine species into disrepute. Unfortunately few species are generally known and these are used in conventional positions in many homes, whether suitable or otherwise, in monotonous regularity.

It should be remembered that many of these plants, because of their particular outline and colouring, are specimen plants; they should be used with restraint and discretion to give added interest or to focus attention on a given point.

The following are some of the more frequent misuses of conifers:

Planting too many specimens in the small garden, thus leading to confusion, each detracting from the other.

The use of golden forms and other extreme colours frequently without relief by some of the green forms.

Clipping into unnatural shapes which is in most cases a waste of effort and is often a means of restricting a larger species where a smaller one should have been chosen.

Planting large species in areas too small to accommodate them. One reason for this mistake is often that wrong information was given as to its growth rate and size at reasonable maturity. Also many people are attracted by the beauty of a young plant and plant it with total disregard for its ultimate size, both in terms of height and width.

The excessive use of strict or upright types gives too harsh and too formal an air to the garden.

Unsuitable specimens are often placed in pots and tubs, which all too frequently dry out to the detriment of the specimen.

Acquaint yourself with the many forms of conifers; upright, prostrate, weeping, formal and informal, which are represented in the many groups. Learn to appreciate their specific cultural and climatic requirements and use the correct plant to add distinction to your garden. •

The Author: Mr. M. Watson, Senior Landscape Designer, Royal Botanic Gardens, Sydney.

TUBERCULOSIS-FREE HERDS

The following herds have been declared free of tuberculosis in accordance with the requirements of the scheme of certifying herds tubercle-free, and unless otherwise declared, this certification remains in force until the date shown in respect of each herd.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Australian Missionary College, Cooranbong (Jerseys)	123	Sept., 1965
Beddie, R. H., Old Grenfell Road, Forbes (Shorthorns)	124	Mar., 1965
Bonnington, R. A., "Leiroy", Shorthorn Stud, "Spring Camp" Curban (Beef Shorthorns)	77	Nov., 1965
Burke, J. & M. P., "Golden Valley", Forbes Road, Cowra (Beef Shorthorns)	62	Mar., 1965
Burnside Presbyterian Orphan Homes, North Parramatta (A.I.S.)	70	July, 1965
Cochrane, R. & C. C., "Parrabel Stud", Bega (Jerseys)	160	April, 1965
De La Salle College, Castle Hill (Ayrshires)	46	July, 1966
Eather, A. D. & J., "Milgarra", Bunnan (Beef Shorthorns)	65	Sept., 1965
Elsinora Pty. Ltd., Manna Stn., Forbes ..	485	June, 1965
Everingham, C., Taree Vale Jersey Stud, Taree	122	Jan., 1965
Ewin, N., "Edenview", Greghamstown, via Blayney (A.I.S.)	60	May, 1965
Fairbairn, C. P. & C., Woomargamma Stn., Hume (Beef Shorthorns)	549	Nov., 1966
Farrer Memorial High School, Nemingha (A.I.S.)	93	May, 1964
Fleming, T. H. & Sons, "Russley", Aberdeen (Polled Shorthorns)	337	Aug., 1965
Franciscan Missionaries of Mary, Range Road, Mittagong (Friesians)	83	Mar., 1965
Freudenstein, F. J. & G. F., "Chippendale", Grenfell Road, Young (Beef Shorthorns)	89	June, 1966
Freudenstein, W. J. A. & Son, "Chippendale", Grenfell Road, Young (Beef Shorthorns)	133	June, 1966
Glen Mitchell Pastoral Co., Wellington (Poll Shorthorns)	170	April, 1966
Grafton Experiment Farm, Grafton (A.I.S., Angus)	436	Aug., 1965
Greaves, J. A., "Baroona", R.M.B. 63, West Wyalong (Beef Shorthorns) ..	44	Nov., 1965
Grey, T. J., Estate, "The Meadows", Albion Park (Jerseys)	147	Sept., 1966
Hawkesbury Agricultural College, Richmond	247	June, 1965
Hill, R. H. and Sons, Bulliac (A.I.S., Jerseys)	71	Oct., 1964
Hurlstone Agricultural High School, Glenfield (Ayrshires)	67	Aug., 1965
Limond Bros., Morisset (Ayrshires) ..	99	Aug., 1965
McSweeney, W. J., "The Rivers", Canowindra (Polled Shorthorns) ..	83	May, 1965
Maloney, D., "Heathvale", Broadwater (Jerseys)	46	Sept., 1966
Markham, J. & E., "Mara", Branxton (Jerseys)	57	Aug., 1965
Mullee Stud Farms Pty. Ltd., "Nairobi", Scone (Poll Herefords)	123	May, 1966
Mutton, J. T. & Sons., Bolwarra, Maitland (Jerseys)	100	Feb., 1965
O'Dea, C., "Sunnyside", Nepean Stud, Nth. Richmond (Friesians)	109	Mar., 1966
Peel River Land and Mineral Co., "Goonoo Goonoo", Tamworth (Polled Shorthorns)	412	Oct., 1966
Pratt, H. F., "Field View", Reserve Creek via Murwillumbah	127	Nov., 1966
Reid, D. B., "Evendale", Sutton Forest (Angus)	179	Dec., 1966
Reid, G. T., "Narrengullen", Yass (Angus)	540	June, 1965
St. Vincent's Boys' Home, Westmead (A.I.S.)	16	June, 1965
Scobie, C. & Son, Abingdon Jersey Stud, Lorn, Maitland	186	Sept., 1965
Simpson, F. S., "Gunnawarra", Gulargambone (Beef Shorthorns)	238	Aug., 1965

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds—*continued*		
Simson, J. N., "Nowley", Spring Ridge (Shorthorns)	227	Feb., 1966
The Scots School, Bathurst (Friesians) ..	31	Nov., 1965
Training Farm for Boys, Berry (A.I.S.) ..	122	Jan., 1966
Trangie Agricultural Research Station, Trangie (Angus)	175	May, 1966
Vitnell, A., Dalwood (A.I.S.)	115	Feb., 1965
Wagga Wagga Agricultural College (Jerseys, Poll Shorthorn)	167	May 1965
Walsh, Mrs. H. R., "Water View", Cowra (Beef Shorthorns)	120	Mar., 1965
Waters, G., "Willow Dell" Jersey Stud, "Boongala", Deniliquin	139	Mar., 1965
White, H. F., Bald Blair, Guyra (A.A.) ..	147	June, 1965
Willis, R. N. & D. M., Westbrook, Mt. Hunter, via Camden (Ayrshire) ..	207	Nov., 1966
Wollongbar Agricultural Research Station, Wollongbar (Guernseys, A.A.) ..	140	June, 1965
Wombramurra Pty. Ltd., "Wombramurra", Nundle (Devon)	136	April, 1966
Wright, Miss I. M., "Awatea Jersey Stud", Paddy's Plains, North Dorrigo	54	Dec., 1966
Yanco Agricultural High School, Yanco (Jerseys)	127	Oct., 1965
Yanco Agricultural Research Station (Jerseys, Guernseys)	115	Dec., 1965
Herds Other than Registered Stud Herds		
Adams, B. & L., "Garryowen", Wallamore Rd., Tamworth	59	Nov., 1965
Adastra Dairies Pty. Ltd., Terrace Rd., North Richmond	106	July, 1966
Baker, R. W., Luskintyre, Lochinvar ..	74	Oct., 1966
Barnardo's Homes, Dr., Tooloogan Vale, Scone	146	Feb., 1967
Bennett, J. F. M., "Oaklands", Pambula	90	May, 1965
Bethsam Holiness Mission, Wyee ..	17	Feb., 1967
Bladwell, W. R., "Loloma", Goulburn	128	Dec., 1965
Bowen, A. H., Stroud	73	April, 1966
Bridge & Bowden, Mill Creek, Stroud Road	47	April, 1965
Brookfield Afforestation Camp, Mannus	268	May, 1965
Brown, R., Valery	58	Aug., 1965
Charlton, R. J., Caniba Street, Lismore	66	Dec., 1965
Chesham, C. H., Picton Road, The Oaks	45	April, 1965
Child Welfare Dept., "Werrington Park", St. Marys (A.I.S.)	34	Feb., 1965
Coilsfield Pty. Ltd., "Coilsfield", Orange	244	Dec., 1965
Cole, E. J. & Sons, Lochiel	127	April, 1966
Cole, G., South Pambula	53	Oct., 1965
C. V. and H. G. Denton, "Yarrawood Farm", Merimbula	91	May, 1965
Croagh Patrick Orphanage, Park St., Orange	61	Feb., 1966
Dunshire, J. S., "Glenara", Riverview Rd., Lansvale	164	May, 1965
Ellensville Est., "Ellensville", Glenmore, via Camden	154	Dec., 1966
Ellwood, H., Attwater Avenue, Cessnock	61	Mar., 1966
Enright, M. (Mrs.), "Hinton Vale", Hinton	95	June, 1966
Fairbridge Farm School, Molong ..	73	Jan., 1966
Farley, D. J., Stroud	88	Dec., 1965
Foley, L. F., Lucknow, via Orange ..	29	Dec., 1965
Forster & Sons, "Abington", Bundarra	53	April, 1966
Franciscan Fathers, Maryfields, Campbelltown	50	April 1966
Gilbert, A. E., Mill Creek, Stroud ..	117	Aug., 1966
Gorton, I. E., Stroud Road, N.S.W. ..	76	Dec., 1966
Greenham, J. R., Hill Creek, Stroud ..	45	Sept., 1965
Harrington, J. B. & J., "Mt. Erin", Campbelltown	97	Nov., 1965

Owner and Address	Number Tested	Expiry Date
Herds other than Registered Stud Herds—*continued*		
Harrington, P. P., "Glen Erin", Leumeah	69	Nov., 1965
Hawkey, H. R., "Trevone", Menangle	271	Nov., 1964
Hawkins, G. A., Freemans Reach ..	63	Mar., 1965
Her Majesty's Training Centre, Emu Plains	164	Feb., 1965
Her Majesty's Training Centre, Goulburn	31	Mar., 1965
Hill, W. S., "Questwill", Crooked Lane, North Richmond	55	July, 1966
Hill, R. H. & Sons, Bulliac	107	Oct., 1966
Johnson, J. R. & P. M., Wallamore Road, Tamworth	123	July, 1965
Kenmore Hospital, Kenmore	120	Mar., 1965
Lee, G. N., Taree	62	Nov., 1966
MacArthur Stanham Holdings Pty. Ltd., Camden Park, Menangle	276	Oct., 1965
McGrogan, J., Percy Street, Singleton ..	83	Jan., 1967
Margery, G. W., Stroud Road, Stroud ..	68	Aug., 1965
Merchant, Mrs. P., East Gresford ..	85	Dec., 1965
Moffit, C. E., Central Tilba	149	Jan., 1964
Monkittee Pastoral Co., Braidwood ..	47	Nov., 1965
Morisset Hospital, Morisset	84	Mar., 1965
Moxham Bros., "Mullengudgery", Mullengudgery	106	Dec., 1964
Mt. Penang Training School (Gosford Farm Homes), Gosford	68	May, 1965
Naroo Pastoral Co. Pty. Ltd., "Jemalong", Forbes	403	Jan., 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong	101	Sept., 1965
O'Dea, C., "Sunnyside", North Richmond	94	Mar., 1963
Odewahn, R., 113 Argyle St., Parramatta	20	Sept., 1965
North Parramatta Psychiatric Centre ..	48	Aug., 1965
Passionist Fathers, Mary's Mount, Goulburn	16	Mar., 1965
Perry, K. T., Millingandi, via Eden ..	69	July, 1965
Pitt, S. R., Wylie's Flat, via Singleton ..	44	July, 1966
Ramsey, E. J., "Manor Park", Parkes ..	100	Feb., 1964
Ryan, P., Hallsville	33	July, 1965

Owner and Address	Number Tested	Expiry Date
Herds Other than Registered Stud Herds—*continued*		
Rydalmere Hospital, Rydalmere ..	28	Nov., 1965
Scott, S., Mullumbimby	71	Sept., 1966
Shelldrake Bros., "Clearview", Box 11, Picton	93	Nov., 1966
Simpson, A. T., "Kenso", Forest Road, Orange	191	April, 1966
Stinson, J. B., Church Lane, Castlereagh	88	Oct., 1966
St. John of God Training Centre, Morisset	22	Sept., 1965
St. John's Orphanage, Goulburn	9	Mar., 1965
St. Joseph's Orphanage, Cowper.. ..	70	Nov., 1964
St. Joseph's Orphanage, "Kenmore", Goulburn	5	Mar., 1965
St. Joseph's Orphanage, Kincumber ..	39	April, 1966
Sternbeck, C. H., Laguna House, Laguna	109	April, 1965
Sydney Church of England Grammar School, Moss Vale (Jerseys)	210	Nov., 1966
Taylor Bros., Tathra Road, Bega ..	145	Nov., 1965
Tegel, A. A. Pty. Ltd., Heath Road, Leppington	92	Nov., 1966
Thompson, L. K., "Redbourneberry", Singleton	85	Mar., 1965
Turner, R. G., "Merriwinga", Tilba Tilba	67	Sept., 1964
Training School for Boys, Mittagong ..	91	Feb., 1966
United Protestant Association, "Sunny Lands", Wollongbar	39	Nov., 1965
Whelan, W. G., Kiah, via Eden	62	Nov., 1966
Whelan, W. R., Bulahdelah	56	April, 1966
Wiley, F. J., Candelo	12	June, 1965
William Thompson Masonic School, Baulkham Hills	66	Sept., 1965
Williamson, R. J., Fattorini Island, Gladestone, N.S.W.	55	April, 1966
Wilson, A. J., Nicholls Street, Stroud ..	57	Nov., 1965
Wilson K., Woodlawn, via Lismore ..	51	Sept., 1966
Wood, Mrs. J., Redbourneberry, Singleton	16	Sept., 1966
Youth Welfare Association of Australia, Hopegood, Bowral ..	241	Dec., 1966

R. M. WATTS, Chief, Division of Animal Industry.

Brucellosis-free Herds (Cattle)

The following herds have been declared free of brucellosis in accordance with the requirements of the scheme of certifying herds brucellosis-free.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Burke, J. and M. P., "Golden Valley", Cowra (Beef Shorthorn)	58	April, 1965
De La Salle College, Oakhill, Castle Hill (Ayrshire)	46	July, 1965
Hurlstone Agricultural High School, Glenfield (Ayrshire)	67	Aug., 1965
McSweeney, W. J., "The Rivers", Canowindra (Poll Shorthorns)	83	May, 1965
"Wombramurra", Pty. Ltd., Nundle (Devon)	135	May 1965

Owner and Address	Number Tested	Expiry Date
Herds Other than Registered Stud Herds		
Fairbridge Farm School, Molong ..	73	Feb., 1966
Mt. Penang Training School, Gosford ..	62	June, 1965
St. John of God Training Centre, Morisset	21	Feb., 1965
Training School for Boys, Mittagong ..	91	Feb., 1966

R. M. WATTS, Chief, Division of Animal Industry.

Brucellosis-free Herds (Swine)

The following is a list of names and addresses of owners of herds which have been declared brucellosis-free in accordance with the requirements of the Brucellosis-free Herd Scheme (Swine).

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Eoyle, W. R., Alford Point Road, Menai (Tamworth and Berkshire)	15	June, 1965
Campbell, D. C., "Hillangrove Stud", Wamberal (Large White)	18	Feb., 1966
Carter, P. L., Woorak Stud, Pine Ridge, via Quirindi (Tamworth & Large White)	37	July, 1965
Draper, R. E., "Glengar", Capertee (Tamworth)	6	Nov., 1965
Farrer Memorial Agricultural High School, Nemingha (Berkshire)	9	April, 1965
Grafton Experiment Farm, Grafton (Berkshire)	15	April, 1965
Hawkesbury Agricultural College, Richmond	55	Mar., 1965
Hurlstone Agricultural High School, Glenfield (Berkshire)	7	Sept., 1965
Registered Stud Herds—*continued*		
Lambeth, A. J., "Talanga", Douglas Park (Berkshire)	11	May, 1965
Maxwell, J. D. "Brooklyn", Barmedman	10	July, 1965
Mt. Penang Training School, Gosford (Berkshire)	10	June, 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong (Berkshire)	7	Aug., 1965
Wagga Agricultural College (Berkshire, Tamworth and Large White)	22	Sept. 1965
Wollongbar Agricultural Research Station, Wollongbar (Tamworth)	29	July, 1965
Yanco Agricultural High School, Yanco (Berkshire)	19	Sept. 1965
Herds Other than Registered Stud Herds		
Brookfield Afforestation Camp, Mannus	14	April, 1965

R. M. WATTS, Chief, Division of Animal Industry.

Areas Undergoing Regular Testing for Tuberculosis

Quarantine Areas (Tuberculosis)—Urban Areas

The following areas have been declared quarantine areas to ensure that a tubercle-free milk supply is available to residents. No cattle from which milk or milk products are obtained for human consumption are allowed to be kept therein unless subjected to the tuberculin test and found free from tuberculosis:

Barraba
Bingara
Braidwood
Casino
Condobolin
Coonabarabran
Coonamble
Crookwell
Glen Innes
Grenfell
Griffith
Inverell
Junee
Kempsey
Moree
Muswellbrook
Parkes
Queanbeyan
Walgett

Quarantine Areas (Tuberculosis)—Eradication Areas

The following areas have been declared quarantine areas for the purpose of eradicating tuberculosis from cattle contained therein. All owners are required to have all their cattle tested for tuberculosis when notice for testing is served:

Bellingen
Bodalla
Brushy Hill
Burringbar
Caniaba
Cessnock
Chichester
Clybucca
Comboyne
Coraki
Cumberland
Denman
Dorrigo
Dungog
Dyraaba
East Casino
East Kempsey
Fawcetts
Illawarra
Kyogle
Lavadia
Lawrence
Lower Hunter
Maitland
Manning
Milton
Moss Vale
Mullumbimby
Myrtle
Nimbin
Nth. Tweed
Salisbury
Singleton
Southgate
South Lismore
Stewart's River
Tintenbar
Tyalgum
Ulmarra
Upper Richmond
Upper Wollomba
Warkworth
West Kempsey
Wingham
Woodburn
Woodford Island

Tuberculosis Protected Area

The following areas have been declared tubercle free and no cattle are allowed to be kept therein unless subjected to the tuberculin test and found free from tuberculosis.

Bombala
Bredbo
Broken Hill
Cooma
Gulgong
Warialda

R. M. WATTS, Chief, Division of Animal Industry.

V. C. N. BLIGHT, GOVERNMENT PRINTER

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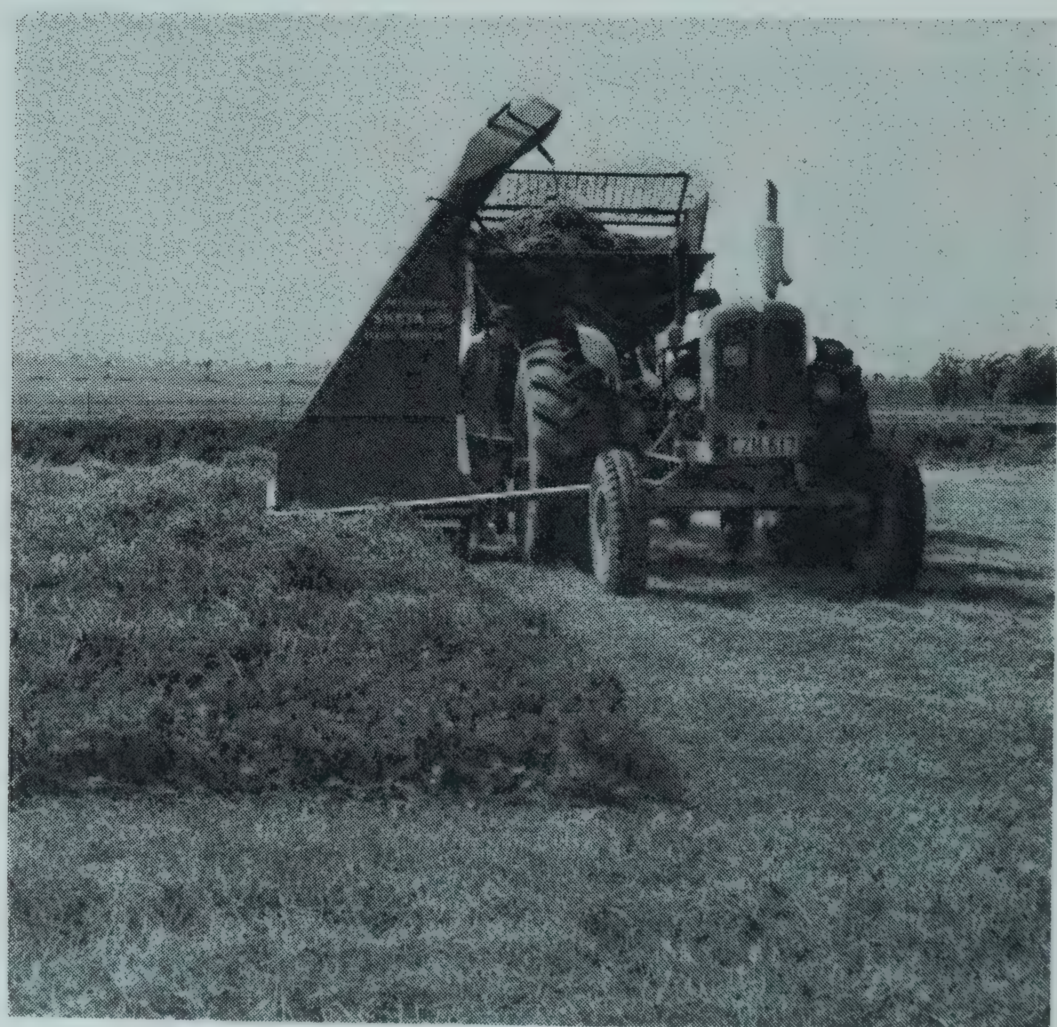
Serving Agriculture—

Yanco Agricultural College and Research Station

F. D. MACKENZIE



Harvesting improved pasture for silage.

The Author: Mr. F. D. Mackenzie, Manager, Agricultural College and Research Station, Yanco.

Yanco Agricultural Research Station was founded in 1908, four years before general irrigation began in the M.I.A. Originally, 320 acres were set aside to form this Station (then known as Yanco Experiment Irrigation Farm). Although no water was available from the Water Conservation and Irrigation Commission's canal, irrigation was practised using water pumped from Yarangery Billabong.

The Station passed from the control of the Department of Agriculture from 1926 until 1940. However, several of the older citrus plantings and one original planting (of pears) remain.

The Station has expanded in size from the original 320 acres to 2,045 acres. Much of the additional land is dry area, situated east of the main canal, and is used for growing pome, stone and citrus fruits.

During the period in which the Station was not controlled by the Department of Agriculture it was the site of the Riverina Welfare Farm. Many of the fine buildings which are a feature of the Station were built at that time. During World War II, the Station operated in part as a prisoner of war camp, containing Italian soldiers. In this time the Station was also a very large vegetable producing unit, run by the New South Wales Department of Agriculture.

Yanco Agricultural Research Station has now two main functions: To carry out research into some aspects of crop and livestock production in the Murrumbidgee Irrigation Areas, on both irrigated and dry land, and to provide tertiary agricultural education through a one-year course in Agriculture for intending farmers.

Long-grained rice is in great demand and at Yanco some six to eight promising crossbreeds are under test.

Climate, soil and topography

Average annual rainfall is about 17 in., of generally winter incidence. Evaporation is high and temperatures vary from an average of 90 degrees in January to 37 degrees in July, with generally low humidity.

Topography varies from low, stony ridges varying from gravel to sandy loam overlying an impervious, cemented sand, to flat riverine plain. On this latter country, soil varies from loam, heavy clay loams to red brown earth.

Much of the ridge is too steep to irrigate, but where the slopes are gentler, and can be irrigated, some are.

An area of approximately 500 acres, west of the main canal is irrigated by gravity.

The main avenues of research are:

Yanco station plays its part in maintaining supplies of foundation seed of hybrid sweet corn.

RICE

In rice research, the avenues explored include the possibilities of aerial sowing, fertilizer requirements, fertilizer placement, early drainage, sod seeding, types of nitrogenous fertilizer, weed control and insect control.

In general terms, aerial sowing of rice has been found a practical possibility, particularly on old land, where good weed control can be obtained. This practice has been used commercially and with success on the M.I.A.

Extensive trials over a number of years, both on the Station and on farming properties, have shown that in the usual rotation of rice and pasture, nitrogen is the only additional fertilizer requirement of rice. The quantities required vary with soil type and previous treatment, and can be fairly accurately gauged by soil tests. The test used has been adapted by Mr. R. Polhill, Rice Research Chemist, at Yanco.

Sulphate of ammonia is generally regarded as the most economic source of nitrogen addition.

Weeds, particularly barnyard grass (*Echnochloa* spp.) cause considerable losses in rice crops. To date, best results in controlling this weed have been obtained by using the post emergence weedicide Stam F34. Trials in heavily infested country (and much of the older rice land is heavily infested) have shown that yields can be lifted by over 1 ton per acre by efficient weed control alone. Several new herbicides appear to be promising.

Insect control, particularly of bloodworm, is being investigated. Control can be gained by use of dieldrin and DDT, but it is felt by research workers that better and less clumsy methods are necessary.

Seed treatment

Preparatory treatment of rice seed with both insecticides and fungicides has been found beneficial to establishment and is practised to some extent by farmers. Seed treatment has produced quite spectacular results in years when early spring is cool and seedling establishment is naturally slower.

Placement of fertilizer

Work overseas suggests that best results can be obtained from deep placement of fertilizer. Extensive trials at Yanco have shown that under our conditions, no benefit accrues from this practice; the normal methods of fertilizing, that is, banding of fertilizer slightly below the seed, is the most effective method.

Rockmelon crossbreds being tested for downy mildew resistance in the glasshouse.

Sod seeding

Sod seeding as a method of sowing rice is gaining in popularity with growers. It appears to offer several advantages over normal methods of sowing. Among these advantages are: Cheaper preparation, additional grazing may be gained, and also greater weed control.

This method of rice establishment is at present being exhaustively investigated.

Rice breeding

The rice breeder has two main problems to deal with: (i) Suncracking of rice grain. Investigation of the causes of suncracking in rice and the development of varieties for cultural practices, or both, to reduce or prevent suncracking; (ii) The production of a long-grained variety suitable for New South Wales conditions.

Suncracking of grain has long been a source of worry to New South Wales millers and farmers, and has caused considerable losses each year.

The practice of high moisture harvesting and controlled drying of paddy rice has reduced the problem to some extent. But it is considered that the real answer lies in rice breeding, and work on this problem has been in progress for some years.

Production of a long-grained rice variety fully suited to southern New South Wales conditions is a pressing problem. Demand for this type of rice is increasing in all quarters, from the food processor to the housewife. The American variety Bluebonnet 50, grown commercially, is only a stopgap until a suitable locally bred variety can be released. Currently, some six to eight promising fixed crossbreds are under test, at Yanco.

Additionally, early generation pure seed of each of the currently grown rice varieties, is produced under strict supervision at Yanco.

Rice is a crop in which purity within a variety is of the utmost importance, and pure seed production is one of the firm foundations on which this industry is built.

COTTON

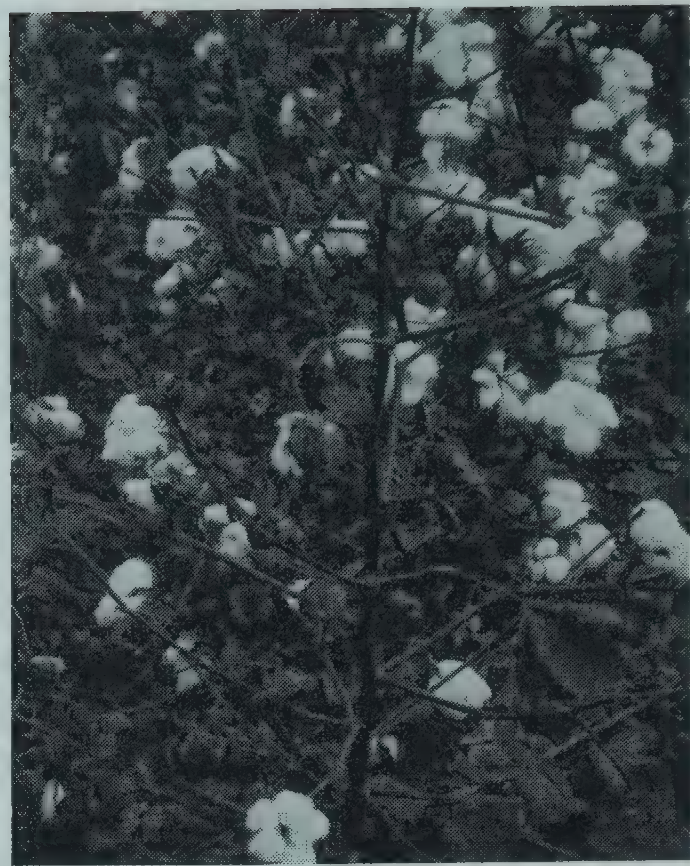
Cotton has been grown for many years at Yanco and on the M.I.A. but only since 1962 has a really determined effort been made to grow large quantities of cotton. With this upsurge in interest and with the establishment of a ginnery at Darlington Point, cotton research has gained in importance.

Research at Yanco and in the surrounding district has mainly been directed to agronomic features.

Main lines followed to date have been toward soil preparation, fertilizer use, water management, insect control, use of weedicides, use of defoliants, and the search for varieties best suited for southern climates and soils.

Results to date show that the crop has great commercial potential, but that skill and experience are necessary for success. Skill of a higher order than that required for other crops is necessary.

Insect pests present a problem but a practical control programme has been worked out, and is being pursued intensively.



The cotton crop at Yanco and the M.I.A. has great commercial potential but skill and experience are necessary for success.

VEGETABLES

Vegetable production has been an important economic feature of the M.I.A. for many years. At Yanco, the vegetable breeder has concentrated on some aspects of four main crops; tomatoes (primarily for the canning trade), beans, peas, and rockmelons.

Tomatoes

Annually, 500 to 600 acres of tomatoes are planted on the M.I.A., and a wastage of up to 33 per cent occurs each year. A major part of this wastage is caused by the disease fusarium wilt. A breeding programme, coupled with testing each year of introductions, has alleviated this position to some extent. The introduced variety Roma, a sauce type, has field resistance to fusarium and is acceptable to the processor but it is not highly regarded by growers. A fixed Yanco crossbred, as yet unnamed, shows great promise in all fields, and 100 acres of it (about 20 per cent of the total area) was planted out in 1964.

Beans

Improved varieties for canning, with a minimum of sidewall fibre, and white seeds, are being sought. This programme is nearing conclusion.

Peas

Varieties suitable for processing, with shorter growing season, higher yield and better quality than those of the existing varieties, Hursthouse and L99 are being sought. These crossbreds have recently been named and released to processors.

Rockmelons

The M.I.A. is an important rockmelon producing area. Most important diseases limiting production and to which commercial varieties are susceptible are fusarium wilt, and powdery mildew. A vigorous programme, aimed at breeding resistance to these diseases, whilst retaining satisfactory quality, is in progress. Some promising crossbreds are now at an advanced stage.

Sheep grazing on improved pasture in rotation with rice.

Other vegetable crops are periodically dealth with, primarily by screening new varieties for possible use under our conditions. Some of these crops are lettuce, onions and carrots.

MISCELLANEOUS CROPS

With the building of a cotton gin, and establishment of an oil expression plant, a trend towards greater production of oil crops has become more definite.

Oil crops which may be profitable and which may fit into the arable rotation include safflower, linseed, soy beans, sesame and mustard, rape, and oil poppies.

Other crops grown include field peas, cow peas, and vetches.

PASTURES

Pastures for both dry and irrigated areas are investigated. Additionally, species and varieties from many parts of the world are grown and seed increased on the Station. Some of these species (and varieties) which have shown promise, may be tested under sward conditions. Such species include *Stipa hyalina*, *Setaria sphacelata*, Israel white clover, Eastern Turkey subterranean clover, and several others. The lucerne strains, Hunter River, African, and Hairy Peruvian are being tested under both dry and irrigated conditions. Generally speaking, none of the varieties is better than Hunter River, and lucerne has proved over many years the best dry area forage plant. On dry areas, Dwalganup and Yarloop subterranean clovers prove most persistent, and considerably more productive than native legume species.

Under irrigation, annual pasture species trials have shown that Marrar, Clare, Bacchus Marsh and Yarloop subterranean clovers are much superior to other varieties, whilst paspalum and white clover remain the standard annual pasture mixture.

At present, a simple trial of improved versus unimproved pasture is being run on unirrigated hill land. This trial is designed to measure, in terms of sheep production, improvements which can be wrought by use of superphosphate and subterranean clover.

Plans are under way to institute a much larger trial, with wider terms of reference, including a critical survey of the economics of improvement under Riverina conditions.

CEREALS

Trials of both wheat and oats are conducted on dry area land. Standard varieties, such as Heron wheat and Orient oats, are used as measuring sticks for new varieties. Additionally, some work using standard soft varieties such as Pinnacle is currently in progress to determine best agronomic treatments for the production of biscuit wheats. Annually about 3,000,000 bushels of wheat are used for making biscuit flour and it is considered that this wheat can be successfully produced under irrigation.

WEEDS

Annually, weeds cost New South Wales farmers a tremendous amount of money. Under the semi-intensive type of agriculture practiced on the M.I.A., the weed problem is a big one. Currently, weeds research is

being carried out at Yanco in three major directions:

Weeds of ditches and channels. Weeds not only lower very considerably the efficiency of water distribution and use, but also act as a reservoir of infestation.

Weeds in rice. It has been shown at Yanco that efficient control of barnyard grass in rice can increase yields by up to 200 per cent. (See under "Rice".)

Weeds in cotton. In cotton, weed control is necessary and is both costly and time consuming. To date, the pre-emergent weedicide is quite promising and economic.

HORTICULTURE

Horticulture is one of the oldest established industries on the area. Main avenues of production are: Citrus for both the fresh and processed market; stone fruit, mainly peaches and apricots for canning; pears, mainly for canning; apples for the fresh fruit market, and prunes, for drying.

Research into each of these fruit crops is conducted. Work in progress includes that on pruning and irrigation techniques; varieties, stocks and scions with citrus, and ways and means to take advantage of transmissible dwarfing strains which can regulate size.

Canning peach work is constantly in progress. One of the important aspects is the continuing search, both by breeding and introduction, for varieties which will lengthen the canning season but maintain the good quality of the main variety, Golden Queen. Periodically, progress is reported at a conference of representatives of all interested branches of the industry. From such conferences stem planting recommendations for the next period. Varieties such as Wight and Windra were bred locally by a Departmental plant breeder.

Apricots for canning are of economic importance and an apricot breeding programme is actively pursued.

Apples, mainly the variety Granny Smith, are grown on the M.I.A., and currently a stock trial using sixteen different stocks is coming into bearing.

Stock trials of citrus, treating the commonly used lemon, sweet orange and trifoliata stocks in comparison with the newer carizo and citrange stocks is in progress.

Work entailing the use of growth regulators on W.B.C. pears is in progress and gives hope of both levelling out production between years, as well as improving the shape, and consequently the canning percentage, of the fruit. Regularity of shape is important where peeling is mechanical.

EDUCATION

At the beginning of 1963 a one-year Certificate Course in Agriculture was begun at Yanco with an initial intake of thirty-eight students.

The aim was to provide a general course in agriculture, primarily for the sons of farmers or those going on the land. It was envisaged that this course would be of a general nature, intensive, and would be a good blend of both the theory and the practice of farming.

In implementing this plan, the course as it emerged, consisted of five disciplines: Farm Management Economics; Agronomy; Farm Engineering; Animal Husbandry, and Practical Agriculture.

The Course has been modified as occasion has demanded, but only within the main framework as outlined. Improvements in both curriculum and in physical facilities have been effected.

The course has expanded to cater for 58 students in 1964 and 102 in 1965.

Improvements effected to date include provision of new accommodation blocks to cater for the increased student intake, building of a new lecture and science block, provision of a woolclassing room on the station, and building up of the welding section of the workshop. Further improvements are envisaged. One will be the establishment of a beef herd, to be managed largely by the students—as the sheep flock is already.

Staff is gradually being added as required, and some use is made of local Technical College officers who teach some subjects. Students from all parts of the State enrol

at Yanco and, because of the general nature of the syllabus, the course is of value to all of them.

CATTLE

Two herds of cattle are run—one is a mixed mob used only for killing for station supplies—the other a Guernsey stud herd. This stud herd is multi-purpose, its uses being: A vehicle for research; a preliminary bull-proving scheme; a stud, particularly for production of young bulls for sale to stud and grade herdsmen; a student demonstration and instruction herd, and a Station milk supply herd.

This herd was moved to Yanco from Wollongong Agricultural Research Station in 1955 and is recognized as one of the best and highest producing Guernsey herds in the Commonwealth.

On the research side, the herd has been used for a study of solids-not-fat production and also for the study of body weight gains of calves.

Bulls are proved as far as possible with the limited number and the breeding of cattle available. At present three Station-bred bulls are at Milk Board artificial-breeding stations.

Young bulls are regularly sold from Yanco and demand exceeds supply; it is generally not possible to sell heifers.

Cattle are regularly exhibited successfully at the R.A.S. Show in Sydney, and at Leeton.

Cattle are used for instruction of students in demonstrations and all students get some experience in handling dairy cattle.

SHEEP

A general average of 2,000 grown sheep are run at Yanco. These include 1,000 merino ewes, 400 first cross Border Leicester x Merino ewes and 400 killers.

At present the Merino ewes are used to breed 1st cross ewes by Border Leicester, Cheviot, and Peppin Merino ewes, for use in experiments at Leeton Agricultural Research Station. The crossbred ewes are used as a demonstration flock by students and lecturers, generally being mated to Downs type rams for lamb production.

The killer flock is also used as a scavenger flock, on fallowing rice banks, for example.

ENTOMOLOGY

An entomologist is stationed at Yanco. Part of his work is done on the farm and part in the district. Particular problems mainly concern the horticulturalist, e.g.; red scale of citrus, codling moth of pome fruit, oriental peach moth of stone fruit, and red spider. He also works with other crops, such as bloodworm of rice, and the multiplicity of insect pests of cotton which can be controlled by properly applied insecticides.

Additionally he is vitally interested and involved in the fruit fly eradication scheme.

New insecticides are appearing regularly and must be screened before being recommended, and a close liaison is kept with all interested growers and producer organizations.

PLANT PATHOLOGY

A plant pathologist with a somewhat similar charter and function to the entomologist is located at the Station. His main interests are in diseases such as brown rot and the many rot organisms attacking fruit trees. This work forms yet another part of the valuable contribution made to agriculture in this State by the Agricultural College and Research Station, Yanco. ●

YOUR CHAIN SAW—

J. G. J. DREVER

Careful running during the first few hours of use will do much to prolong the life of your saw.

THE LIFE OF A CHAIN SAW depends largely on how the saw is used during its first few hours of work. It should not be put on to work on heavy sawing until it is first run in carefully. Most manufacturers recommend the following procedure:

The chain tension should be adjusted so that it can be pulled around the bar by hand. It is best to use gloves for this operation.

The engine should then be started up and run for a few minutes. It is important to lubricate the chain during this run.

Next, stop the engine and allow it to cool down—then check the chain tension again.

Repeat this two or three times before starting to saw.

The Author: Mr. J. G. J. Drever, Agricultural Engineer, Farrer Place, Sydney.

how to use it safely and keep it working well

The first few cuts should be made on small diameter timber. After the first half hour's cutting stop the saw and allow it to cool down, then readjust the chain tension.

Do not adjust chain tension when either the engine or the saw is hot, for the chain will contract when cold and become over-tight. This could damage the sprocket, oil seals, bearings and crankshaft.

Sharpening

The chipper chain is easily blunted, and must be kept sharp.

On a new saw all the teeth are the same length, all the angles are the same and all the depth gauges or rakers are set at the correct depth. These features must be maintained during the life of the saw. This is difficult to do by "freehand" filing, but there are mechanical aids on the market which make it simple. Sharpening should be done with a special chain saw file.

When purchasing a chain saw make sure that you also obtain a chain saw sharpening kit for your particular chain saw. This kit usually comprises a special file, a file holder or file guide to position the file accurately in relation to the tooth being sharpened, a file vice and a depth gauge template.

Different sized files are necessary for different model chain saws.

The chain saw will naturally have to be sharpened after varying intervals, depending on the type of wood being sawed. Some woods are so hard that the saw has to be sharpened after one or two hours cutting time.

It is not always necessary to take the chain off the saw to sharpen it. If the teeth have not been allowed to become too blunt, a few strokes per tooth is often all that is necessary to restore its good cutting qualities.

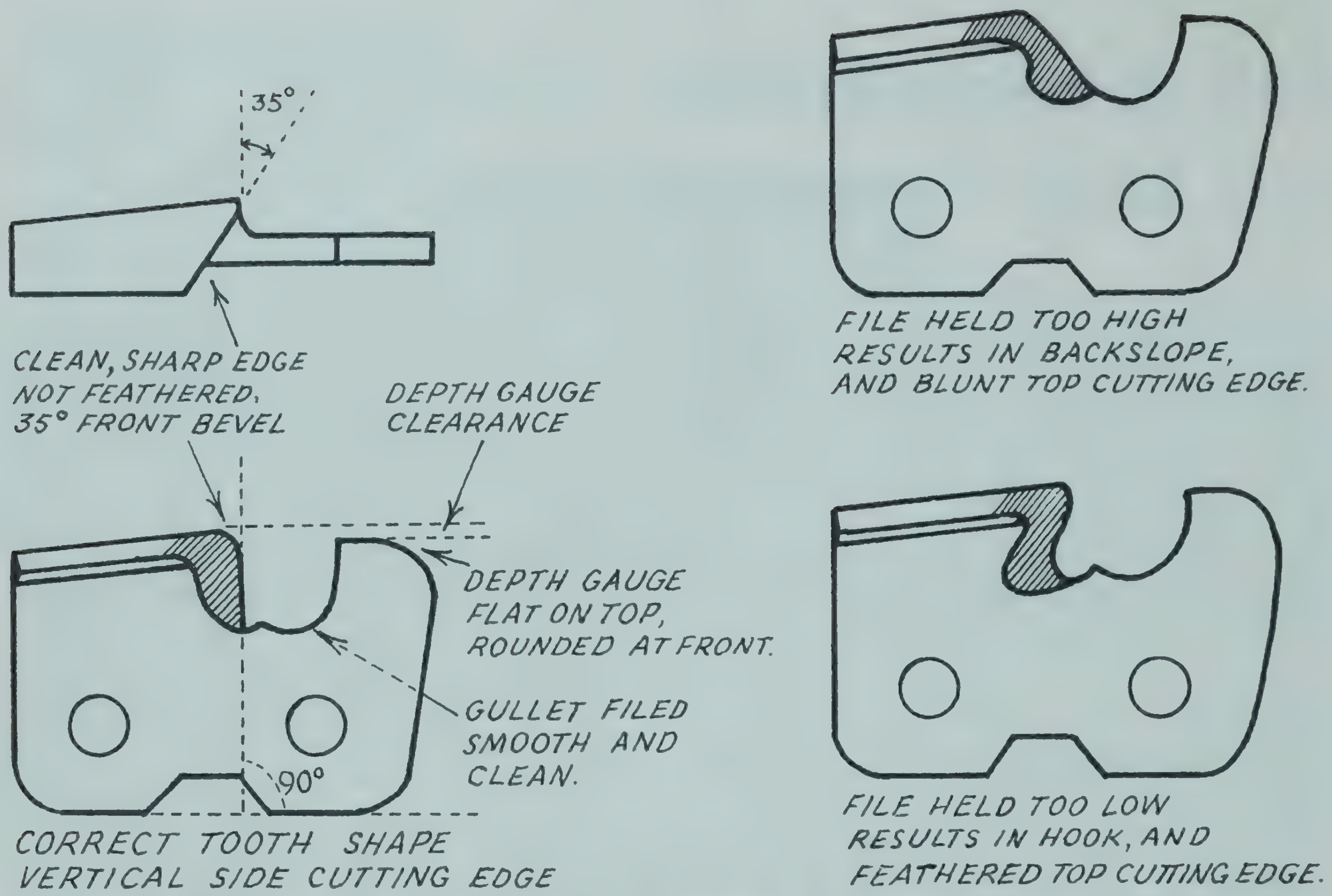
Continual sharpening of the chain on the saw is not recommended because steel filings find their way between the links of the chain and into the bar groove, causing rapid wear. It is best to buy a chain sharpening vice and sharpen the chain on it. This also helps you to file the teeth to the correct front level angle.

When teeth become very blunt, the saw will not cut properly even if great pressure is put on the bar. If a blunt saw is used this way, excessive clutch slip takes place and this causes the clutch drum to overheat and burn out the clutch shoes.

Blunt teeth and heavy pressure on the bar also causes the chain to wobble and this wears the runners on the bar. The rivet heads on the chain also become polished by the badly cut wood, and this gives the operator the impression that the saw has lost its set. Some people attempt to reset the teeth. Never attempt to reset chipper-type chain saw teeth. The only solution is to sharpen the teeth.

The depth gauge, sometimes called a raker, which is located directly in front of the cutting tooth, must be accurately filed when sharpening the chain saw. It has no cutting function, and so should not be bevelled but filed off horizontally to the manufacturer's recommended clearance below the top of the tooth. It should also have the leading edge rounded off to prevent penetration into the wood. Depth gauge filing jigs are usually supplied with filing kits, or can be readily obtained from saw dealers.

Sprockets are subject to wear, but this can be minimised by keeping the chain sharp, properly lubricated and run at the correct tension. If a sprocket becomes worn it should be replaced promptly. It should always be replaced if the tooth wear exceeds 1/10 inch. Worn sprockets can cause a chain to wear out long before its normal useful life is finished. Worn sprockets cause



Sharpening: Hold the file so that 1/5th of file diameter is above cutting edge. Do not allow file to wobble from side to side or up and down. File with a long forward stroke, and apply pressure sideways, never downwards. Do not file on the return stroke, and use filing bit for best results.

the chain to stretch and chatter and this in turn damages the driving links on the chain. Always check the condition of the sprocket before fitting a new chain. Many manufacturers recommend that you fit a new sprocket every time you fit a new chain.

Chain tension

Many manufacturers recommend that the chain be tensioned so that it can be pulled around by hand (use a leather glove to do this), but it should not be so loose that it will sag on the underneath side of the cutter bar.

If it is too tight it will cause excessive wear on the sprocket. It will also wear the bearing surfaces of the chain which run on the cutter bar rails, and cause the nose of the bar to overheat.

If it is too loose, the chain will flap up and down and hammer the bar, particularly at the point of entry after it passes around the sprocket. This hammering produces rapid wear, particularly to the bearings surfaces and drive links of the chain, and damages the chain entry groove on the bar.

Fitting new chains

Dealers often supply new chains with a coating of rust preventive on them. Although they look oily, these coatings are not always good lubricants. It is advisable to read the manufacturer's instructions before opening the package, and follow them.

It is desirable to soak a new chain in grade SAE30 lubricating oil before use to ensure it is adequately lubricated before attempting to fit it.

After fitting the chain, adjust it to the correct tension as outlined above. "Run in" the saw for about one hour, making light cuts only, and use plenty of oil. Some manufacturers recommend low speeds for the running in period. Adjust the tension on the saw as frequently as necessary. Most of the stretch that will occur with the chain take places in the running in period.

Cutter bars

Rails on cutter bars are subject to several kinds of wear. If one rail wears more than the other the chain will lean over to the side.

If both rails become badly worn the driving links will ride on the bottom of the groove.

The rails can also spread and this causes the chain to wobble. Whenever any of these troubles occur it is best to send the saw to a competent chain saw repair shop. Special tools are necessary for these repairs.

Sawdust can also accumulate in the grooves of old saws. Worn sprockets tend to round off the square bottoms of the drive links and then they are no longer efficient in clearing out the sawdust from the bottom of the groove and they tend to ride over it. The groove should be cleaned out every time a chain is removed.

Bars should be reversed periodically to balance out wear on the rails.

Lubrication

Always use clean, new oil. It is better to use new oil than to be continually replacing cutter bars and chains that have become worn through bad lubrication. Do not under any circumstances use old sump oil drained from farm vehicles. Each rivet in the chain has many bearing surfaces and without proper lubrication they will soon become worn prematurely and reduce the life of the saw.

Some manufacturers recommend that the chain be removed and placed in an oil bath in off seasons if it is not being used continuously. This is to ensure that the oil reaches all parts of the chain. The oiling system on the saw will supply sufficient lubricant while the saw is operating, but it will not in many saws effectively lubricate all the bearing surface sufficiently for long periods of non use.

The efficiency of lubrication will be greatly increased if before making a cut the chain is oiled whilst it is travelling at low speed.

The chain oiler should be used continuously during heavy cutting. It is of utmost importance to make sure the oil holes at the entrance to the bar are always kept free of sawdust.

Good lubrication is one of the best means of increasing the life of the saw and reducing maintenance costs.

Engine maintenance

The lubrication of the internal parts of most chain saw engines is done by the oil in the petrol-oil mixture with which it is fuelled. It is of the utmost importance that the correct mixture, recommended by the manufacturer, be used.

When filling the tank always do so with a funnel containing a fine screen to eliminate water and particles of dirt.

Fuel and air filters are fitted to prevent foreign matter entering the engine, so check and clean them frequently. If they are completely blocked up, renew them.

Cooling fins are used to transfer the tremendous heat from the combustion chamber to the atmosphere. Sawdust must not be allowed to accumulate in them as this upsets the cooling system and lowers the efficiency of the saw.

Exhaust ports can become completely blocked up with carbon, so have a look at them periodically. In some models it is possible to remove the silencer and turn the engine until the piston is clear of the exhaust ports. With a blunt tool remove any carbon deposits that are there and wipe off all the small particles before reinstalling the exhaust chamber.

Storage

If it is not intended to use the saw for prolonged periods the fuel tanks and carburettor must be completely drained. Otherwise, the petrol will evaporate and leave a sticky oil deposit which will cause blockages in the carburettor and fuel system.

Consult manuals

The hints above are of a general nature; for fuller details of preventive maintenance, saw owners should familiarise themselves with their operator's manuals.

"Safety-first" should always be the aim when using chain saws. A little time spent in understanding the safety hints given in this article could very well save you from serious accidents —or worse.

SAFETY HINTS

The following are chain saw safety hints prepared by the United States National Safety Council in co-operation with the Power Saw Manufacturers' Association.

"Whether timber getting is your line of work, or you fell only an occasional tree, if you use a chain saw to do it, here are some things worth knowing. . . ."

Equipment

Know your saw.

Keep your saw in good condition and easy to start.

Keep it clean, free of oil, petrol, sawdust and chips.

Use a sharp chain and keep it properly tensioned.

Keep spikes sharp and handles in good shape.

Study manufacturer's maintenance instructions.

Have your saw checked regularly by your dealer.

Clothing

Hard hat (suspension system with full brim).

Shoes with safety toe protection.

Trousers with no cuffs.

Well-fitting clothing.

Safety glasses are desirable.

Wear ear plugs when using saw continuously.

Hazards

Cuts from chain.

Falling limbs.

Falling trees.

Falls while carrying saw, or on an escape route.

Strains or sprains.

Saw kicking from binding.

Burns from exhaust.

Cuts while filing.

Preparation

When carrying a saw, stop the motor, carry it with the blade to the rear, obtain good footing, and lift with legs, not with back.

Size up tree and surrounding area for danger from nearby trees and snags. Consider shape and lean of the tree, direction of the wind, availability of a bed and anything that the tip of the bar could strike while cutting.

Clear work area of brush. Know escape route. Don't cut brush with chain saw, or brush will whip.

To start saw, place it on level ground, get a good footing, hold saw firmly with one hand, while pulling the starting cord with the other. Pull cord away from your body. Keep the saw and chain in good condition.

Undercutting

Make undercut facing direction of fall; this controls direction of fall.

Depth (penetration) should be one-third of tree's diameter. This keeps full control of the tree while falling.

Height (opening); in diameters under 18 inches, a V-shaped undercut may be desirable.

Never fell a tree without a proper undercut.

Backcutting

Be sure of your footing.

Work above undercut so tree will not kick back.

Sound warning cry before starting chainsaw. Make sure no one is in the danger area.

Set dogs, or spikes, securely.

Don't cut through holding wood on either side. If you do, tree might spin off the stump when it falls.

Wedge-shaped holding wood will put tree to the side of the thickest holding and will counteract lean of tree.

Lean into saw to keep it from kicking.

Side notching is used if the saw blade is too short, or if the tree has heavy lean in direction it is to be felled. This prevents splitting up from the stump.

Slow down cutting action as chain approaches notch to control direction of fall.

If your chain saw binds, **stop the saw.** Use wedges to free it. Never operate saw with one hand while pushing with the other.

A push pole should always be used when aiding a worker using a saw.

Retreat from tree

Keep the saw in the cut until the cut opens. Remove saw, stop motor, and place saw on the ground away from direction of fall.

Retreat at least 25 feet, at a 45° angle from the direction of fall, over a previously checked escape route.

Watch for falling limbs.

Stand behind other trees.

Limbing

Keep a firm grip on the saw.

Have a good footing.

With small logs, stand on side opposite limb being cut.

If on a hillside, work on the uphill side.

Trees in lodged positions should be unlodged before limbing.

Watch the spring, or jump, of the limbs being cut.

Do not cut limbs that are propping the log.

In limbing, work from the butt end of the tree toward the top. More accuracy can be obtained at the lower side of the limb than at the crotch.

The chain should be stopped when saw is being carried over limbs and brush.

Use a chain designed for limbing.

Be alert for anything that can touch the nose and cause kickback.

Logging

Clear up the work area.

Block the tree, if necessary, so that it will not roll.

Cut logs only in firm position.

If on a hillside, work on the uphill side.

Slope the cut so the log drop will open the cut. This will prevent binding the saw.

If the saw binds, stop the engine and wedge or pry free.

On large logs, stand against the saw to keep it from kicking. On small logs stand with legs wide apart, straddling the cut, or stand to one side.

Do not attempt dangerous cuts. Wait until the log is moved to a safe area.

Slow the motor down, and hold it at a distance from your body, just before the cut is completed.

Watch the tip of the bar so it does not come in contact with foreign objects.

Filing chain

When filing chain on saw hold saw securely.

Pull chain around bar with stick or other object. Do not pull chain by hand, unless gloves are worn.

File and check chain only when engine is stopped.

Always keep your chain sharp and properly maintained for safe cutting.

General safety measures

Fill the fuel tank on an area of bare ground.

Use the oil and petrol mixture recommended by the manufacturer.

Wipe spilled fuel off the saw.

Keep the muffler clean, in good condition, and tight on the saw.

Carry fuel only in safety cans.

Fill the fuel tank with the engine turned off.

Start the engine away from the refueling area.

Always have a blanket, fire extinguisher or other means available to put out fires.

Always have a first aid kit handy.

Do not smoke when refueling.

Let the saw cool a little before refueling, especially if the saw has been worked heavily just before refueling.

Do not operate saw if it is backfiring or missing.

Do not leave saw idling unattended.

Check area for signs of smouldering before leaving cutting area.

Transportation and storage

Do not carry saw in passenger compartment of vehicles.

Drain fuel tank.

Run engine until petrol is out of carburettor.

Store the saw level and so it will not shift in transit.

A bar guard, or cover, is good protection for the chain and the operator.

Check saw thoroughly when taking it out of storage.

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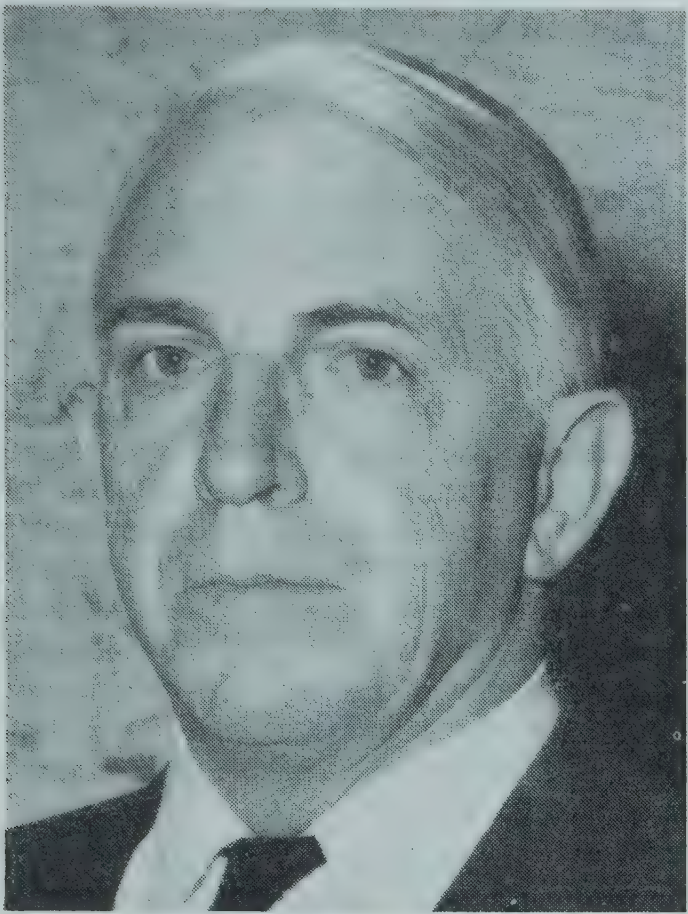
Dr. H. J. Hynes, Director, Retires—
Mr. R. M. Watts Appointed Deputy Director-General



DR. H. J. HYNES retired in April from the position of Director of Agriculture, after almost 46 years in the New South Wales Public Service.

He joined the Department as a Scientific Trainee in 1919. After returning from studies in the United States he joined the Biology Branch, and subsequently became Chief Biologist in 1940.

During the War he was Administrative Officer, Premier's Department, in connection with the Premier's State War Effort Co-ordination Committee. Dr. Hynes was subsequently Assistant Director of Rural Manpower in the office of the Director-General of Manpower, Sydney.

He was then appointed first Chief of the Department of Agriculture's Division of Marketing and Agricultural Economics, in 1943. In 1947 he was appointed Assistant Director of the Department, and in 1959, Director of Agriculture.

Dr. Hynes' many appointments included membership of the Poultry Advisory Board, the Wheat Industry Research Council, and the Fauna Protection Panel.

He is a past President of the New South Wales Branch of the Australian Institute of Agricultural Science and a life member of the Royal Society of New South Wales. He was the first Editor of the Journal of the A.I.A.S. ●

MR. R. M. WATTS, B.V.Sc., has been appointed to the newly constituted position of Deputy Director-General of the Department of Agriculture. He succeeds Dr. H. J. Hynes, who retired from the position of Director of Agriculture on 2 April.

Mr. Watts joined the Department in 1936 as a veterinary officer. Subsequently he rose through the position of Principal Veterinary Officer to become Deputy Chief of the Division of Animal Industry. Then, in 1960, he was made Chief of the Division, and Chief Quarantine Officer (Animals).

As Chief, he was also President of the Veterinary Surgeons' Board, Chairman of the Stock Medicines Board, and Chairman of the Rabbit Control Advisory Committee.

In addition, he was a member of the Poisons Advisory Committee, Animal Production Committee, Cattle Tick Control Commission, Cattle Tick Research Advisory Committee, and the Coordinating Committee on Pesticides.

In 1962 Mr. Watts was a member of the Commonwealth delegation to an international meeting on pesticides, convened by the F.A.O. in Rome. Subsequently he visited Great Britain for discussions on animal disease programmes. ●

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Post-harvest Sterilization of Oranges Against Queensland Fruit Fly

D. LEGGO*, J. G. GELLATLEY†, J. A. SEBERRY*, I. D. PEGGIE‡, J. K. LONG*, AND E. G. HALL¶

Commercial EDB fumigation chamber (Wyong Co-operative Citrus Packing House Ltd.).

FOR QUARANTINE PURPOSES, New Zealand has recently officially recognized ethylene dibromide (EDB) fumigation of packed oranges as an acceptable measure against Queensland fruit fly. This follows the successful completion of considerable research in Australia on post-harvest sterilization methods, research in which the Australian citrus industry and State and Federal authorities have collaborated closely since 1955.

The culmination of this work in an economically practical and effective method of treating oranges from fly-affected areas in Australia is expected to have far-reaching results. Besides having a beneficial effect on interstate trade in oranges, the process is likely to open up new export possibilities for Australian citrus in the Philippines and elsewhere, as well as in New Zealand.

The Queensland fruit fly, *Dacus* (*Strumeta*) tryoni (Frogg), has caused serious interference to trade between fly-affected citrus areas in Australia and places here and abroad where there are quarantine barriers against the fly.

What was required was a technique of post-harvest sterilization which would not only be effective against Queensland fruit

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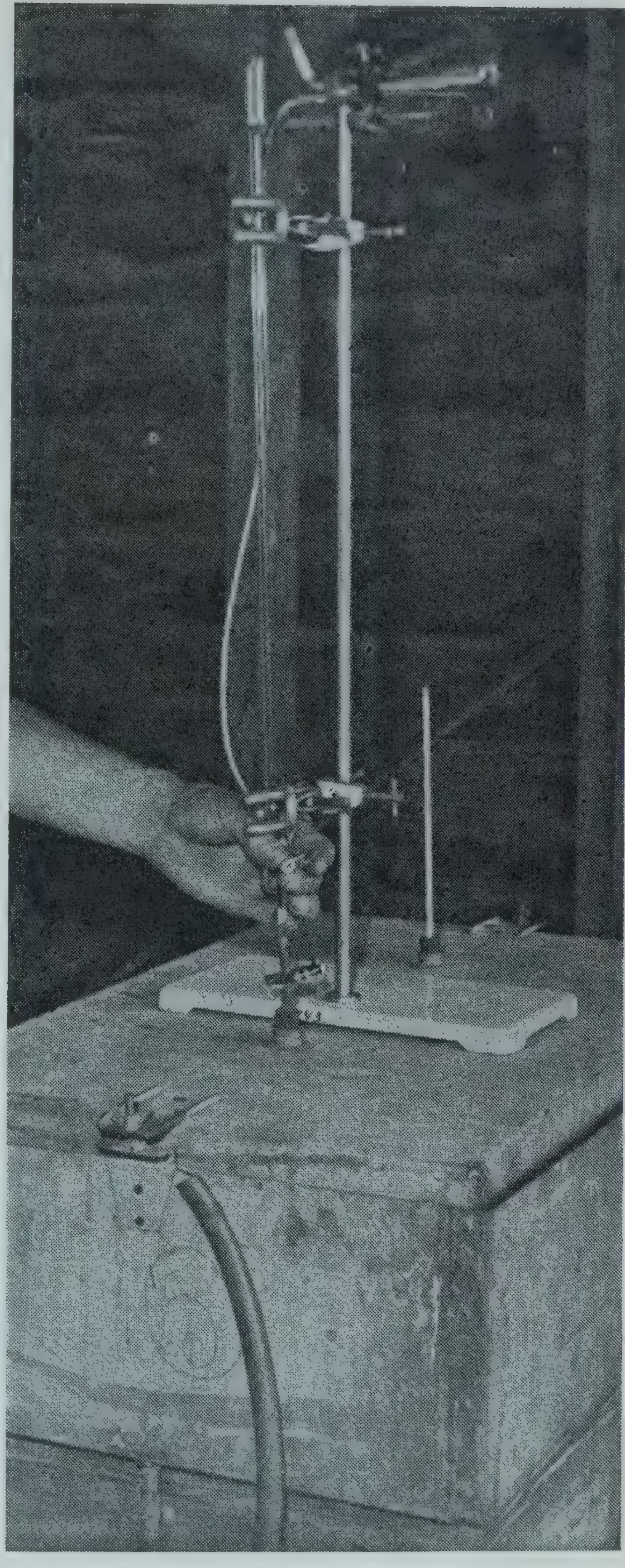
A similar article was published in Food Preservation Quarterly

fly but would be economically practicable and acceptable to the citrus industry.

In 1955 the Federal Citrus Council of Australia requested that research in this field be intensified and co-ordinated. Subsequently, the Technical Committee on Fruit Fly Sterilization Investigation in Citrus was established to initiate and direct investigations. This committee comprised representatives of the Department of Primary Industry, of C.S.I.R.O., and of the Departments of Agriculture of New South Wales, Victoria, and South Australia. Funds for the investigations were contributed on the basis of one-quarter each by the Commonwealth and the Federal Citrus Council of Australia, and one-sixth by each of the three States.

Earlier investigations had shown that a vapour heat treatment developed by the United States Department of Agriculture(1) for sterilization of citrus injured Australian fruit. Investigations were therefore undertaken into sterilization by low-temperature storage, and by fumigation with ethylene dibromide (EDB), since these treatments were in use in other parts of the world against other species of fruit fly. More recently, work was commenced on gamma irradiation, these studies being undertaken by the C.S.I.R.O. Division of Food Preservation in collaboration with the Australian Atomic Energy Commission.

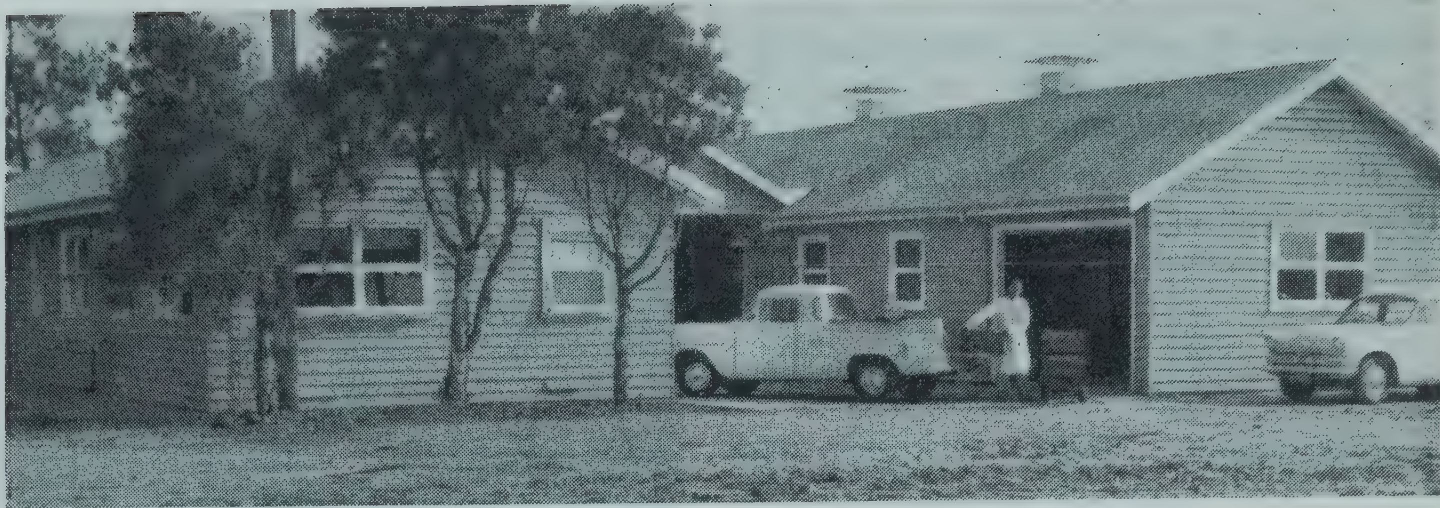
Artificial infestation of oranges with Queensland fruit fly was necessary for the experimental work. Oranges are not a preferred host of fruit fly, and even from areas where fly was abundant it was not



EDB being added to experimental (10 cu. ft.) fumigation chamber, at the Citrus Wastage Research Laboratory.

possible to obtain enough naturally infested oranges.

Oranges were therefore infested artificially by deep implantation of eggs collected from laboratory-bred fruit flies. The method used was developed by A. H. Friend(2), an



Citrus Wastage Research Laboratory, Gosford. Investigations on EDB fumigation of citrus fruit have been in progress at this centre since 1956.

entomologist of the New South Wales Department of Agriculture. It enabled several hundred heavily infested oranges to be produced each week.

LOW TEMPERATURE STERILIZATION OF ORANGES

In 1955, New Zealand quarantine regulations already allowed the entry of South African oranges stored at 31° ± 1°F for 21 consecutive days as a sterilization treatment against fruit flies. Trials showed that the 21-day low temperature treatment caused excessive injury to Australian oranges, but that injury after 14 days cold storage was usually negligible.

In thirteen trials of the low-temperature treatment for 14 days, using artificially infested Valencia oranges, only two larvae out of 19,571 survived, and even these failed to develop into adult flies

New Zealand authorities accepted the treatment in May 1956, and it has since been used for Australian oranges exported to New Zealand from fruit fly areas. However, it is not favoured by the trade because of the space, time and cost involved; there is also some risk of cold injury.

ETHYLENE DIBROMIDE (EDB) FUMIGATION

Investigations in Hawaii and California showed that fumigation with EDB for two hours at 70°F or over was a satisfactory quarantine measure against Oriental and other fruit flies. This treatment was subsequently approved as a condition for entry of Hawaiian fruits into the mainland of U.S.A.[3]. The EDB treatment has the practical advantage that it is quick and requires relatively inexpensive equipment.

After preliminary studies at Sydney and Gosford, special laboratory and insectary facilities were built at the Citrus Wastage Research Laboratory, Gosford, and investigations were commenced in 1956.

Investigations at Gosford

Early trials at Gosford showed that the fumigation dosage rate recommended in Hawaii against Oriental and other fruit flies was not adequate against Queensland fruit fly in oranges. Higher dosages and the possibility of fruit injury at these levels were examined.

Another problem was to determine dosages, for various fruit temperatures, that would obviate the necessity of heating fruit to 70°F, as such heating would be time-consuming and expensive. Valencia and Navel oranges were used in the trials, and the initial work was confined to unpacked fruit in field cases. For mortality studies the oranges were artificially infested.

Most of the fumigations at Gosford were done in experimental 10 cu. ft. galvanized-iron chambers containing two field cases, each case holding one bushel of oranges. This represented a 40 per cent loading of the chamber. Liquid EDB was heated, and the resulting vapour was circulated constantly by an electric fan. Distribution of EDB was found to be uniform in fruit in various positions within the 10 cu. ft. chambers and also within a larger, 550 cu. ft. fumigation chamber.

As a first step, fumigations were carried out at 50°, 60° and 70°F. The minimum dosage of EDB likely to kill 100 per cent of the larvae at each of these temperatures was estimated. Later, many experimental fumigations were made at these temperatures to find out exactly what dosages were necessary to ensure that all the larvae were killed. In separate experiments the movement of EDB into and out of the juice of fumigated oranges was studied.

Tests on fruit injury

Since the early work showed that high concentrations of EDB can cause rind injury to oranges, the dosages proposed for the larval mortality studies were widely tested for fruit injury. Surveys at Gosford with coastal oranges, and, in Victoria, with oranges from the Lower Murray River citrus areas, showed that injury was not likely at the dosages required for satisfactory sterilization.

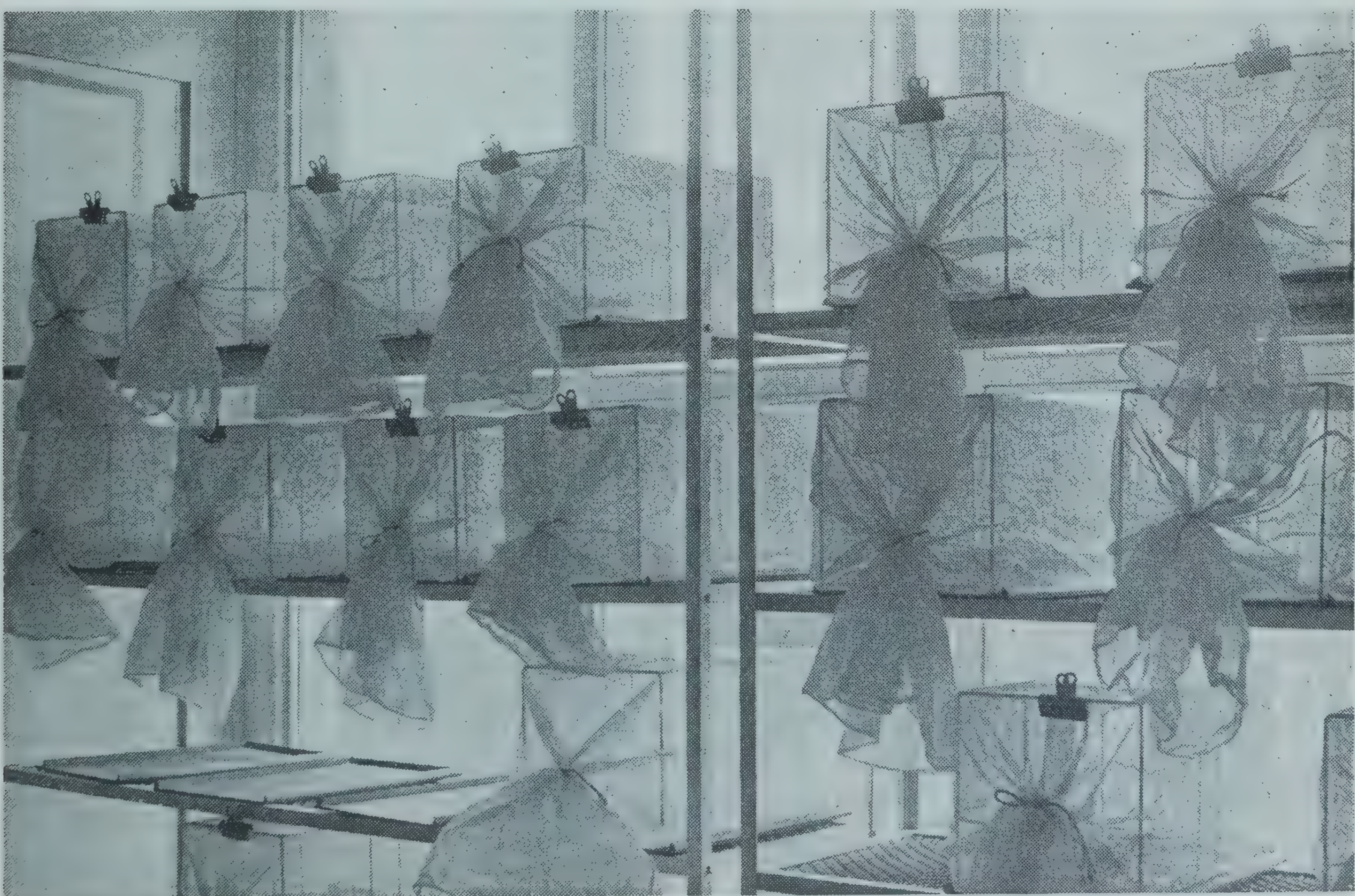
The effect of variation of chamber load on EDB absorption and rind injury was examined in trials at Mildura. Reducing the loading rate from 30 per cent to 15 per cent increased EDB absorption considerably, but often caused development of severe rind injury. On the other hand, increasing the loading rate from 45 per cent to 60 per cent had little effect on absorption of EDB by the fruit.

Tests on toxicity

Tests were also made to ensure that oranges fumigated with EDB would not present a health risk to consumers. According to standards laid down by the United States Food and Drug Administration[4], these tests showed that under the least favourable conditions the fruit would be acceptable five days after fumigation. Oranges exported to New Zealand would not arrive at the market less than a week after fumigation and would therefore meet this requirement.

Acceptance of the treatment

Studies of various problems associated with EDB fumigation continued until 1961. After 275 experimental fumigations the total kill was 175,669 larvae, with only 4 survivors (see table). There were no survivors at EDB dosages now recommended for commercial use.



Cages of Queensland fruit fly in the insectary at the Citrus Wastage Research Laboratory

Larval deaths after fumigation with EDB for 2 hours

Fruit Temperature	Dosage (oz./1000 cu. ft.)	No. of Fumigations	Larvae Killed	Larvae Surviving
70°F or over ..	18*	38	24,506	0
	16	111	60,785	3
60°F ± 3°F ..	24*	28	39,136	0
50°F ± 3°F ..	32*	49	25,232	0
	24	49	26,010	1
Total	..	275	175,669	4

* Dosages recommended

In August 1961, New Zealand authorities accepted EDB fumigation of *unpacked* oranges as a quarantine treatment.

It was still necessary, however, to test the treatment on commercially packed fruit. Trials at Gosford showed that washed, fungicidally treated, waxed, and wrapped packed oranges could be fumigated in a similar manner to unpacked fruit. Trial shipments to New Zealand were made in 1963, and in January 1964 New Zealand authorities accepted EDB fumigation for washed, waxed, wrapped and packed oranges.

For commercial application of the EDB treatment, the fumigation chambers must comply with certain specifications for design and performance, and each fumigation must be supervised by a Departmental inspector. A guide entitled "Instruction for the Design, Official Testing and Routine Operation of Fumigation Chambers" has been issued by the Technical Committee on Fruit Fly Sterilization Investigation in Citrus.

INVESTIGATIONS ON OTHER FRUIT

A new series of EDB fumigation trials, on lemons, mandarins, and grapefruit, has now been commenced at the Gosford laboratory. A cold-storage sterilization treatment for pears is also being studied.

To deal adequately with these activities the Technical Committee now includes a representative from the Queensland Department of Primary Industries. The Committee is now known as the Fruit Fly Commodity Treatment Committee. Funds for the new citrus investigations are being provided by the Commonwealth, the citrus industries of New South Wales and Queensland, the Departments of Agriculture of New South Wales, Victoria, and South Australia, and the Queensland Department of Primary Industries. The pear work is being carried out with funds provided by the Northern Victorian Fruitgrowers' Association, the Victorian Department of Agriculture, and the Commonwealth.

IRRADIATION STERILIZATION

Irradiation as a possible method of post-harvest sterilization of fruit against fruit fly is also being studied by the Division of Food Preservation of C.S.I.R.O. in conjunction with the Australian Atomic Energy Commission. So far it has been found that Queensland fruit fly in oranges can be killed by low doses of gamma radiation, but it is not certain whether rind injury can be avoided. When suitable commercial irradiation facilities become available this may prove a useful method of quarantine treatment.

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(4) United States Food and Drug Administration (1957)—Summary of tolerances and exemptions of pesticide chemicals.

Internal Parasites of Sheep

USE THE RIGHT DRUG FOR THE JOB

J. S. Healey

Nodules caused by nodule worm in wall of bowel.

THERE are now on the market many drugs for the removal of worms from sheep. Selection of the one most suitable for a particular case is a difficult matter.

It is easy to use a drench whose efficiency is below requirements. On the other hand, sheep can be given an expensive treatment when a cheaper one would suffice.

Many considerations govern the choice of a worm drench. These include where the property is, the time of the year, quality of feed, the species of worms likely to be present, cost of the drench, and whether treatment is for curative or general control purposes.

In this article particulars are given of the principal drugs used for the removal of worms. This will assist stockowners to choose the drugs most suited to their particular requirements.

ROUND WORMS

Round worms cause most of the known worm troubles. They inhabit the stomach, small intestine and large intestine. The most important are:

- Barber's pole worm (*Haemonchus contortus*)—in the fourth stomach. (Also called the large stomach worm.)
- Small brown stomach worm (*Ostertagia* spp.)—in the fourth stomach.

The Author: Mr. J. S. Healey, Principal Veterinary Officer (Extension), Farrer Place, Sydney.

Bowel of sheep affected with nodules caused by the nodule worm

- Black scour worm (*Trichostrongylus* spp.)—in the small intestine.
- Thin-necked intestinal worm (*Nematodirus* spp.)—in the small intestine.
- Nodule worm (*Oesophagostonium columbianum*)—in the large intestine.
- Large-mouthed bowel worm (*Chabertia ovina*)—in the large intestine.

The following drugs are effective against these worms:

Thiabendazole (Thibenzole ®). Thiabendazole is the most efficient drench for removal of mixed worm infestations from sheep. It can remove 95 to 98 per cent of the adults of all species of round worm commonly affecting sheep in Australia, with the exception of the whip worm. Against this species its action is poor, but whip worms do not usually cause trouble in sheep.

A very important feature of thiabendazole is its high efficiency against the larval stages of most worms. Other drugs are less effective against immature worms. Thiabendazole has a wide margin of safety, so there is little risk of toxicity resulting from overdosage. It is given in a relatively small dose, making for ease of administration. It does not stain wool.

The high efficiency of thiabendazole against larval worms makes it an ideal drench for sheep showing symptoms from mixed worm burdens when the season favours spread of the infestation. In a field experiment by the C.S.I.R.O. under these conditions it took three treatments with the commercial grade of phenothiazine to achieve the result obtained with a single dose of thiabendazole. Further work by the C.S.I.R.O. on the central and southern tablelands has shown that weight gains are greater after thiabendazole is used than when other drenches are given.

The effect of thiabendazole on worms is almost immediate. One hour after drenching there is a detectable decline in the output of worm eggs. After eight hours the

® registered trade name

passage of eggs has virtually ceased. This means that 2 to 3 hours after treatment sheep can be transferred to a clean paddock with little risk of it becoming contaminated. However, because of its rapid elimination from the body, thiabendazole provides no protection against reinfestation. If, therefore, treated sheep are placed on contaminated ground, further infestations may be quickly acquired. A feature of worm infested sheep drenched with thiabendazole is the rapid improvement in appetite following treatment.

It has been suspected, but not confirmed scientifically, that if thiabendazole is used too intensively on young sheep, they may not carry enough worms to stimulate the development of immunity.

In the United States it has been found that resistance of barber's pole worm to thiabendazole follows the repeated use of this drug.

Thiabendazole cannot be used for the removal of tape worms, lung worms or flukes. The cost of a dose of thiabendazole for an adult sheep is approximately 9½d. It is thus more expensive than many other worm drenches.

Phenothiazine-phenzidole mixture (Phenovis 2 ®, Coopazine 2 ®). Phenothiazine may be combined with phenzidole, the mixture giving a more powerful action than that of phenothiazine alone. Against adult round worms this drench has an efficiency comparable with that of thiabendazole. Although it does act against larval parasites it falls somewhat short of thiabendazole in this respect.

Of the existing drenches it can be said that the phenothiazine-phenzidole combination has an all round efficiency second only to that of thiabendazole. However, sheep carrying heavy mixed worm burdens under conditions favouring spread of infestation have made better weight gains after treatment with thiabendazole.

The phenothiazine-phenzidole combination is relatively safe. Its phenothiazine content gives the mixture similar wool staining properties to those of phenothiazine itself. It is not recommended for ewes within the month before lambing.

The cost is about 7d. per adult sheep dose.

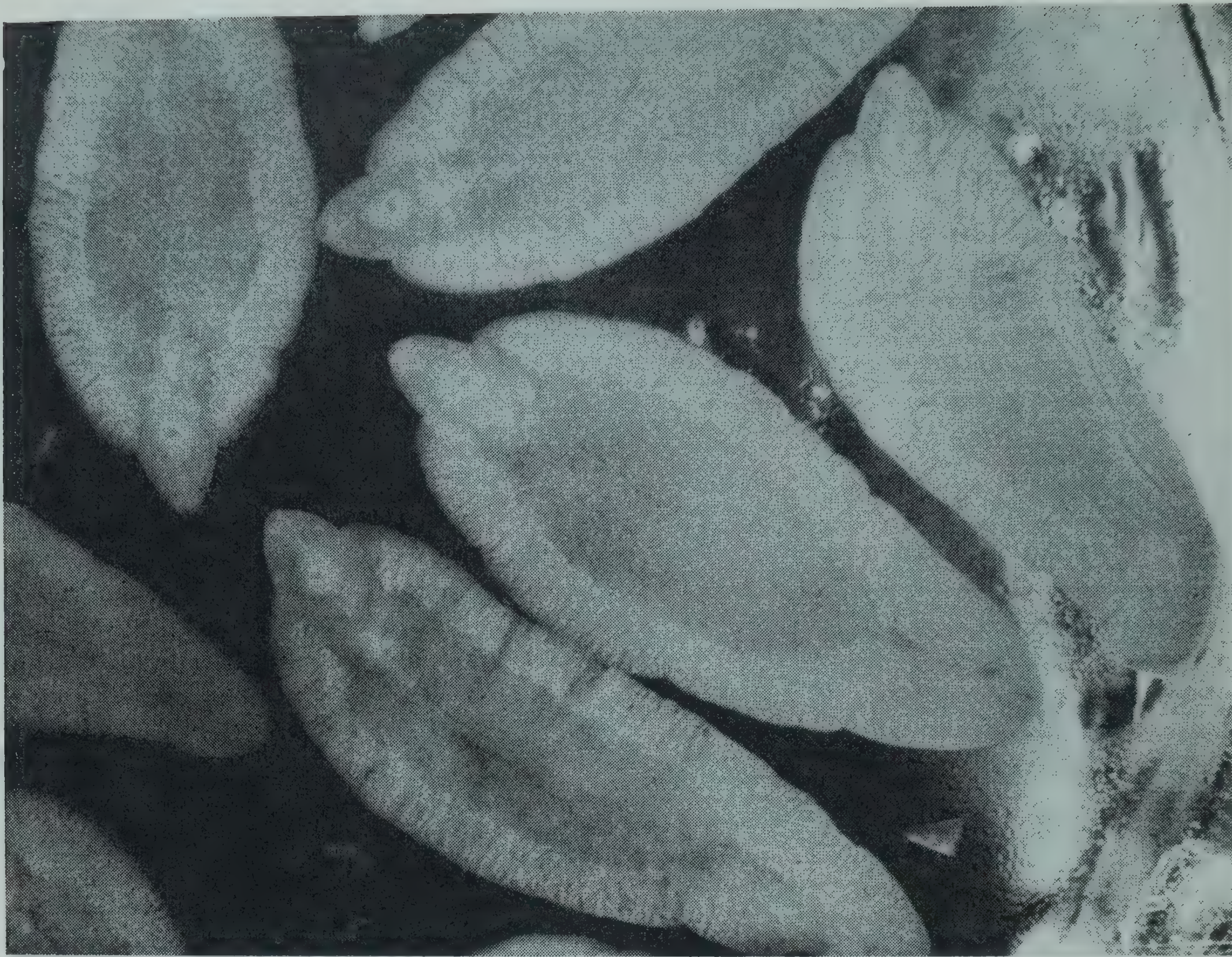
Ultramized Phenothiazine ®. The smaller the size of phenothiazine particles, the greater the efficiency. Ultramized Phenothiazine consists of smaller particles than in other commercial grades, and is also of higher purity. For the removal of adult worms it is similar in efficiency to thiabendazole. The latter however has superior action against larvae.

Ultramized Phenothiazine is not recommended for ewes within the month before lambing. It should not be given within three weeks of dosing with carbon tetrachloride. It sometimes causes a temporary setback by depressing appetite, particularly in young lambs. Sensitivity to sunlight, particularly of the eyes, may at times follow treatment of lambs. The risk of toxicity is increased if sheep are denied access to water after treatment.

Ultramized Phenothiazine does not suspend well with water, and it stains wool. An adult sheep dose costs approximately 9d. Used at a lower dose rate for the large stomach worm only, the cost is about 6d.

Phenothiazine. Until recent years phenothiazine was the most efficient and widely used drench for worms in sheep. It is still a valuable drench against worms. Phenothiazine has a very high level of efficiency against the barber's pole worm, and good efficiency against the black scour worm, the nodule worm and the large-mouthed bowel worm. Its action against the small brown stomach worm and the thin-necked intestinal worm is only moderate.

A disadvantage of phenothiazine in comparison with thiabendazole is that it has little effect on larval parasites. However, because of its relative cheapness and efficiency against the large stomach worm, phenothiazine is useful for treating parasitism in sheep where large stomach worm alone is involved. Furthermore, it has a place in the strategic drenching programme for worm control.



Adult liver fluke

Phenothiazine causes staining of the wool. The side effects that may arise from the use of Ultramized Phenothiazine can also follow use of other commercial grades of the drug.

An adult sheep dose costs about 3¾d. at the level recommended for large stomach worm and about 5d. for other species.

Methyridine (Mintic ®). Methyridine has an efficiency comparable with that of thiabendazole against both larvae and adults of the round worms inhabiting the small intestine. Against the worms of the stomach, however, its efficiency is erratic. This feature limits its value for sheep in view of the importance of the barber's pole worm. The high cost (1s. 2d. per adult dose) also militates against its use.

Methyridine has good action against lung worms and is the only one of the treatments for gastro-intestinal worms to possess this property. It also will remove tape worms to some extent. It cannot be given at the same time as diethylcarbamazine (Franocide ®, Banocide ® Carocide ®).

Bephenium (Frantin ®). Bephenium has a very powerful specific action against both adults and larvae of the thin-necked intestinal worm. It is also efficient against the barber's pole worm, the small brown stomach worm, the stomach hair worm and the nodule worm. It is only moderately efficient against the black scour worm. It is too expensive for general use, costing 3s. per adult sheep dose.

Montrel (Kempak ®). Montrel is one of the organic phosphorus compounds. It is highly effective against the barber's pole worm and has good efficiency against the black scour worm and the small brown stomach worm. It is not recommended where the thin-necked intestinal worm is involved. Its action is too irregular for it to be considered for the treatment of

sheep suffering from nodule worm infestation. It does not remove many larval worms. It is non-wool staining and the dose is small.

In common with other organic phosphates, montrel does not have the margin of safety of many other drenches. Directions and precautions on the manufacturer's label should be followed carefully. In particular, anything likely to cause stress or excitement to the sheep needs to be avoided. Concentrate feeding, if practised, should be suspended a week before treatment. Yarding should be for the minimum required period. Toxicity is increased if sheep are dosed during cold wet weather. Carbon tetrachloride and montrel are best not used within three weeks of each other, or within three weeks before or after dipping in an organic phosphate. Antidotes in the form of atropine or PAM are available should toxicity symptoms occur. The drug should be handled with care because of possible toxicity to persons.

Montrel costs about 4d. per adult dose at the lower dose rate recommended for the barber's pole worm and approximately 7½d. at the level required for other worms.

Asuntol (Co-Ral®). Asuntol is also an organic phosphate. Among the more important worms, it has very high activity against the barber's pole worm and good activity against the black scour worm. The precautions required when using montrel must also be taken with asuntol. It costs about 2½d. per adult dose.

Neguvon. Neguvon, also an organic phosphate, is only recommended for the removal of the barber's pole worm. This limits its use in sheep. The dose that would need to be given for the removal of intestinal worms would be likely to cause poisoning. The remarks made regarding possible toxicity of montrel, and precautions to be taken also apply to neguvon.

Neguvon is highly efficient against adult barber's pole worms. The dose for a grown sheep works out at about 2½d.

Piperazine. The action of piperazine is limited to the nodule worm against which it is particularly effective. Piperazine is usually given mixed with bluestone and arsenic to allow a wider range of application. Mixtures of this type retail at about 2¾d. per adult dose. When piperazine is combined with bluestone and nicotine sulphate there is a risk of toxicity, particularly if sheep are in poor condition or are overheated.

Carbon tetrachloride. Carbon tetrachloride is extensively used for the treatment of liver fluke. At a dose of 2 cc. for adults and 1 cc. for lambs, carbon tetrachloride is valuable for the removal of both the barber's pole worm and adult liver flukes. It is administered mixed with liquid paraffin to make a combined dose of 5 cc. This concentration is usually referred to as double strength carbon tetrachloride, the weaker strength to be used solely against liver fluke being designated single strength. The dose used for the barber's pole worm is twice the quantity necessary to eliminate adult liver fluke. Carbon tetrachloride is therefore very useful when both these parasites have to be dealt with. The action of carbon tetrachloride against the barber's pole worm is perhaps not as powerful as some of the other drugs. Nevertheless, it can be used as a strategic drench in the late summer in areas where such drenching is warranted against liver fluke and large stomach worm.

Carbon tetrachloride has the disadvantage that very occasionally heavy losses from poisoning may result. A drench technique which favours slow swallowing of the drench has been shown to predispose to toxicity. Other happenings that can increase the risk of toxicity are undue stress in yarding and returning sheep to paddocks, and treating in cold, wet weather. Sheep feeding on sorrel, soursob, stinkwort or the leaves of the Kurrajong tree must not be drenched with carbon tetrachloride.

Carbon tetrachloride must not be given to ewes within the month before lambing. It is inadvisable for sheep to receive carbon tetrachloride and an organic phosphate within 3 weeks of each other.

The cost of 5 cc. double strength carbon tetrachloride is less than ½d.

Bluestone-nicotine sulphate mixture. The combination of bluestone and nicotine sulphate is reasonably effective against the barber's pole worm and the black scour worm. It is not efficient enough for the treatment of sheep showing clinical symptoms but can be used in strategic drenching programmes. Its main attribute is its extremely low cost. Commercial supplies are available at about 1d. per adult dose. Stockowners can also make their own mixtures.

To avoid risk of poisoning, care is needed to ensure that the recommended doses for the various classes of sheep are not exceeded. Sheep also have to be yarded quietly, and promptly returned to their paddocks in the same manner after treatment.

Bluestone-arsenic mixture. The combination of bluestone and arsenic provides moderate action against the barber's pole worm and tapeworms. The cost is about 1d. per adult dose.

LUNG WORMS

Lung worms which may affect sheep are:

- Large lung worm—(*Dictyocaulus filaria*).
- Small lung worm—(*Muellerius capillaris*).

There are no drugs for removing the small lung worm but the following act against the large lung worm:

Cyanacethydrazide (Dictycide ®, Helmox ®, Cydrazin ®). Cyanacethydrazide is very efficient for the removal of adults of the large lung worm. It acts by anaesthetising the worms which are then coughed up and eliminated by the sheep. It is not effective against larvae of the worm.

The drug is commercially available in a form suitable for drenching and also in another form for subcutaneous injection. Affected sheep can be given either a single, large dose of the drug, or a smaller quantity on each of three successive days. The cost of the former is about 11d. for an adult sheep.

Diethylcarbamazine (Franocide ®, Banocide ®, Caricide ®). Diethylcarbamazine has the advatage over cyanacethydrazide in that it will remove the older larvae as well as adults. However it is less efficient than cyanacethydrazide against adult worms. At times a single treatment may be sufficient but for best results sheep have to be treated on each of three successive days. The drug is available both for administration by drenching and by subcutaneous injection. A procedure sometimes adopted is to give the first day's dose by subcutaneous injection, and the next two by drenching.

The cost is about 1s. 3d. per adult course of treatment.

Methyridine (Mintic ®). Methyridine has been mentioned in connection with the removal of gastro-intestinal worms. It is the only material active against both bowel and lung worms. While possessing good activity against lung worms it is less efficient than either cyanacethydrazide or diethylcarbamazine.

TAPE WORMS

Tapeworms (*Moniezia* spp.) only occasionally cause trouble, and then only in lambs.

The following drugs may be used:

Yomesan (Lintex, Mansonil ®). Yomesan is the most efficient drug available for the removal of sheep tape worms. In many cases it eliminates all such worms carried by sheep being treated. It is also very safe. The cost is about 1s. 6d. per 100 lb. live weight of animal.

Arsenic. Owing to its relatively low cost, arsenic has been widely used for the elimination of tape worms. When treating for tape worms exclusively, lead arsenate is probably the most suitable form of this chemical. It will remove most tape worms carried by sheep. However, there is a risk of toxicity if sheep in very poor condition are treated.

A mixture of bluestone and arsenic may be employed for moderate activity against both tape worms and the barber's pole worm.

Approximate efficiency of drugs against adult worms of different species

Drug	Barber's Pole Worm	Small Brown Stomach Worm	Black Scour Worm	Thin Necked Intestinal Worm	Nodule Worm	Large Mouthed Bowel Worm	Tape-worms	Large Lung-worm	Liver Fluke
Thiabendazole	+++	+++	+++	+++	+++	+++	—	—	—
Phenothiazine-phenzidole	+++	+++	+++	++	+++	+++	—	—	—
Ultramized Phenothiazine	+++	+++	+++	++	+++	+++	—	—	—
Phenothiazine	+++	++	++	++	+++	++	—	—	—
Methyridine	+	+	+++	+++	+++	+++	..	..	..
Bephenium	++	++	+	+++	++	+	—	+	—
Montrel	+++	++	++	—	—	—	—	—	—
Asuntol	+++	+	++	—	—	—	—	—	—
Neguvon	+++	—	—	—	—	—	—	—	—
Piperazine	—	—	—	—	+++	—	—	—	—
Carbon tetrachloride	++	—	—	—	—	—	—	—	+++
Bluestone-nicotine Sulphate	++	+	+	+	—	—	+	—	—
Bluestone-arsenic	++	—	—	—	—	—	+	—	—
Cyanacethydrazide	—	—	—	—	—	—	—	++	—
Diethylcarbamazine	—	—	—	—	—	—	—	++	—
Yomesan	—	—	—	—	—	—	+++	—	—
Lead arsenate	—	—	—	—	—	—	++	—	—
Hexachlorophene	—	—	—	—	—	—	—	—	+++

+++ More than 95 per cent adult worms removed.
++ 75-95 per cent adult worms removed.
+ 50-75 per cent adult worms removed.
— Less than 50 per cent adult worms removed or otherwise not recommended.

LIVER FLUKE

The following drugs will remove liver fluke:

Carbon tetrachloride. Reference to the use of carbon tetrachloride against the barber's pole worm has already been made. At half the dose recommended for this parasite, carbon tetrachloride will remove adult liver fluke. This dosage is provided by 5 cc. of single strength mixture.

Previous remarks regarding possible toxicity of the drug apply equally to treatment for liver fluke, even though a weaker dosage is used.

By increasing the quantity given to 15 cc. of double strength mixture (that is, 6 cc. of carbon tetrachloride) action against larval flukes can be obtained. This dosage entails some increased risk of toxicity.

Hexachlorophene (Fascophene ®). Hexachlorophene is very efficient in removing adult flukes. It will also act on the older larval flukes. Some deaths following the use of the drug have been reported.

If hexachlorophene is to be used it is advisable to treat 6 to 10 head, and wait 48 hours before drenching the remainder. If sickness or mortality occurs in the pilot group treated, the drug should not be used on the rest.

Hexachlorophene should not be given to lambs under 5 months of age or to ewes either a month before or after lambing. Weak and stunted sheep should be given two-thirds of the recommended dose. Treatment should not be repeated in less than 4 weeks. A similar period should elapse between the use of hexachlorophene, carbon tetrachloride and an organic phosphate.

The cost of hexachlorophene is about 3d. per adult dose.

Conclusion

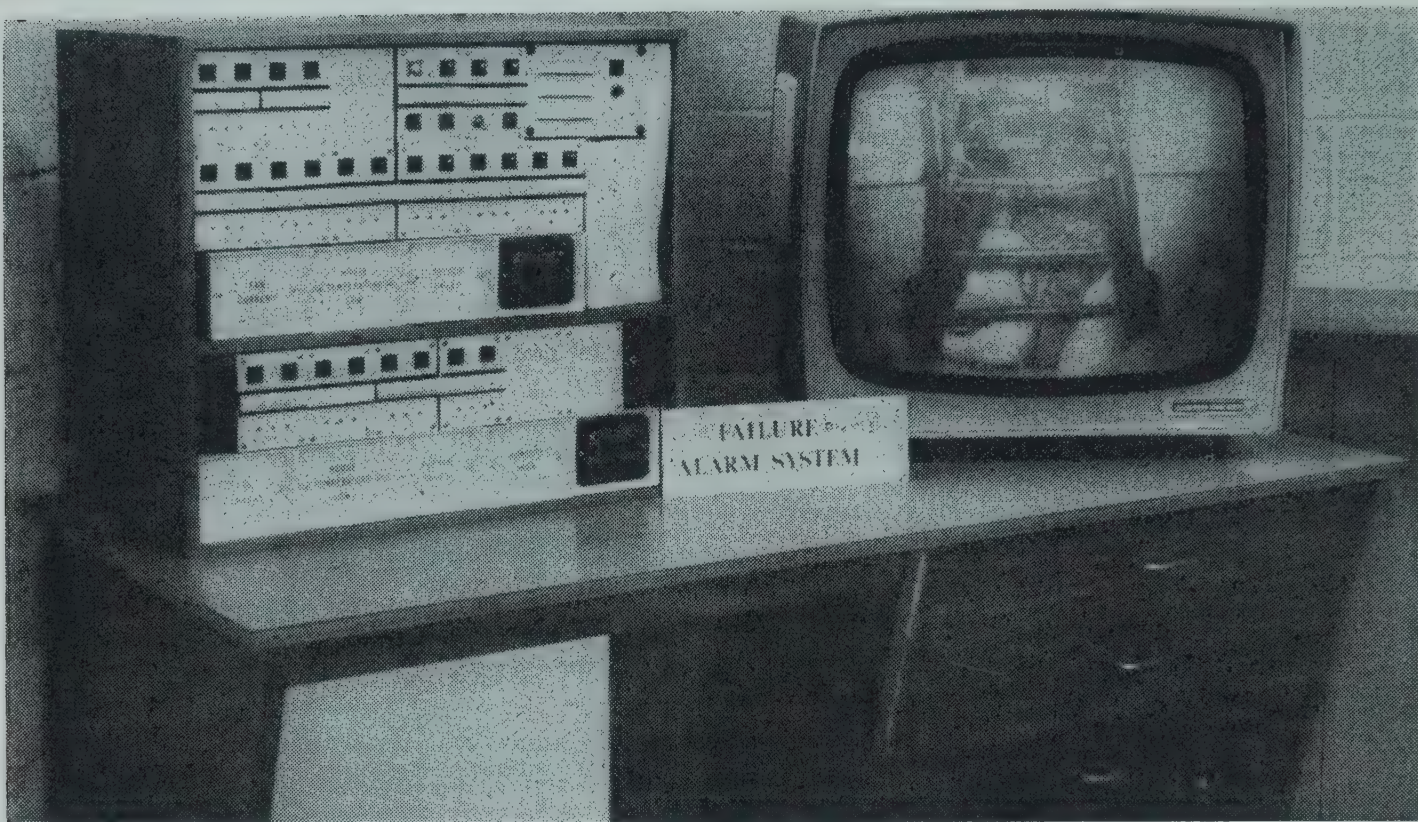
Although treatment aspects of worm control only are dealt with in this article, the attack on sheep worms is essentially a three-pronged one. It is based on:

- Drenching at appropriate periods.
- Rotationally grazing paddocks to reduce intake of worm larvae.
- Providing good quality feed to build up the resistance of sheep to worms.

The approximate efficiency of the more widely used worm treatments against the various species of parasites, is summarised in the accompanying table. ●

TV Aid on British Farms

British Information Services



A corner of the modern farmer's office showing closed-circuit TV screen (right) with control panel (left) for TV pictures and automatic air conditioning and feeding installations.

Closed-circuit television, together with other modern devices, is helping Britain's progressive farmers to lower production costs, save staff time, and bring agriculture in line with other modernised fields of industry.

Some interesting automatic devices, mainly electronic and electro-mechanical, for the agriculturist, are making their appearance, bringing the industry to a peak of efficiency which is probably higher than anywhere else in the world. At a farm in Sussex, for example, one man can now handle the automatic feeding of 900 pigs, and calves can even be "mothered" automatically.

Perhaps the most useful thing on the farm is the closed-circuit television installation which enables the farmer to see—from office, sitting room or bedroom—how his stock is faring. And a modest installation can be had for about £300 in Britain.

The ideal application for closed-circuit television, and perhaps the one with the most practical value, is for keeping a watch on an animal about to give birth; the television equipment allows the farmer or stockman to keep an eye on the "patient" without actually being with it. Other uses allow the farmer to watch feeding animals and poultry, and to keep an eye on a sick animal.

Ordinary closed-circuit television, using co-axial cables, is effective up to about ten miles range but improvements are being made in passing television signals over ordinary telephone wires, and this means it will soon be possible to use closed-circuit television over much larger distances. •

Avena ludoviciana

Wild oats as they emerge from header—*Avena ludoviciana* above, *Avena fatua* below; note variations in colour, hairiness.

Avena fatua

WILD OATS—

Poor Relations in Wheat

A. D. MEARS

THE EVER PRESENT black or wild oats are the poor relations of wheat in this state. Prolific in some years and restricted in others, wild oats are always a real or potential nuisance.

Over recent years there has been an increasing interest in the weed. Farmers are coming to realise that its grazing value on fallows and in pasture land is poor compensation for the reduction it causes in wheat yields. Also, heavier infestations of the weed are becoming evident in southern areas.

There is little of the wheat belt in which wild oats are not a potentially serious crop weed. Many thousands of acres of crops are seriously infested each year. Grain yield can be reduced by as much as 15 bushels per acre and product quality can be reduced seriously by an infestation.

Two species of wild oats are concerned. *Avena fatua* and *Avena ludoviciana.* Southern infestations are predominantly of the former; northern crops are mostly infested with the latter. They are similar in appearance and in season of growth under Australian conditions.

Good management practices can reduce the spread and degree of infestation. Such practices include correctly timed cultivations, crop rotation, and grazing; they are subject to seasonal and climatic variations however.

The Author: Mr. A. D. Mears, Senior Agronomist, Farrer Place, Sydney.

Wheat crop infested with wild oats, showing effect of spraying with barban; sprayed portion at right of picture.

Competition for nutrients

Wild oats' rapid early growth robs young wheat plants of nutrients. This effect is most severe in years when moisture is limited in the first few weeks of crop growth. Oats are vigorous competitors throughout their growing period, which is identical with or slightly ahead of that of wheat. They always obtain first call on the available moisture and soil nutrients.

Often, infestations are so slight that yield reduction would be difficult to measure. In heavier infestations, yield reduction has been as great as 15 bushels an acre. Accurate studies of levels of infestation necessary to reduce wheat yields by a given amount have not been made. Any level of infestation is undesirable.

Without some form of control, infestation will, in time, create serious competition for the crop. Control measures should commence once the weed is noticed. The efficiency of these measures will be reflected in following seasons.

Quality of product

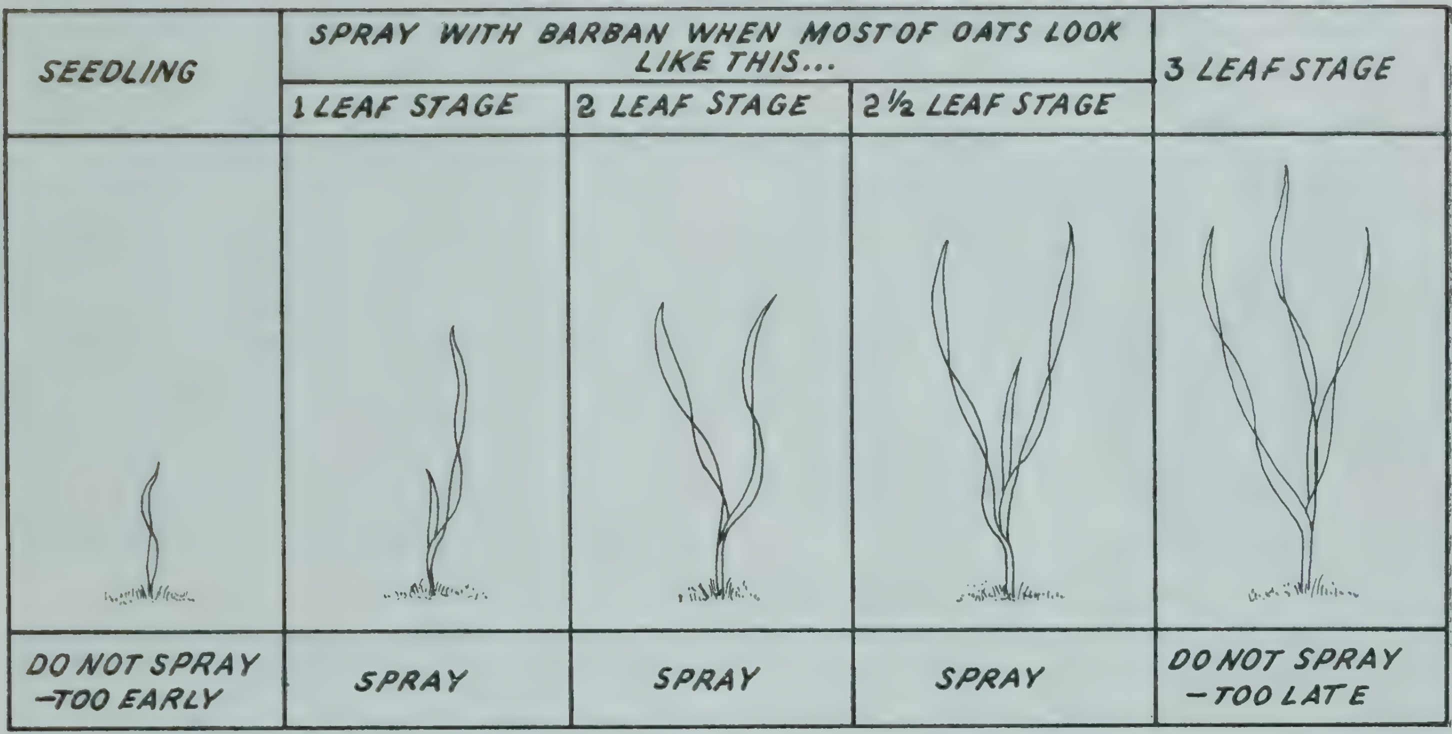
Nutrient competition reduces yield, but the presence of the seed in produce is also serious. Levels of impurities in seed have been set by the New South Wales Agricultural Seeds Act. Seed samples which contain as little as 0.25 per cent of weed seeds, one of which is wild oats, are below standard. While the seed may be extracted, it involves extra cleaning and therefore extra cost. Wild oats seed in grain for milling also reduces its chance to command premium prices.

Fodder which contains wild oats is not as desirable as clean fodder, and buyers may be wary of buying it. The early maturity of the weed will increase the chances of the presence of mature grains in fodder.

Differences between species

Under English conditions there is a major difference between *A. fatua* and *A. ludoviciana* in the period of germination. *A. fatua* has the capacity to germinate in any season, but has a peak germination in autumn and spring. *A. ludoviciana* by contrast germinates almost solely in winter. Under New South Wales conditions there does not seem to be this difference. There are other species of wild oats in the State, but these are of virtually no importance in wheat areas.

Recognition of the two major species is made difficult by the extreme variability of the colour and hairiness of the seeds and



For a crop situation, some oats will be in each of the above stages.

husks. However, the most reliable single character for differentiation is that of seed shedding. *A. fatua* sheds mature seeds singly; with *A. ludoviciana*, mature seeds are shed in attached pairs.

Control measures

Eradication of wild oats is not completely achievable, but the weed can be satisfactorily controlled by a number of practices used together. These include: Prevention of initial infestation; crop rotation and grazing; crop competition and chemical spraying.

Prevention of infestation is important in areas which have not been reached by the pest, or where it is restricted to certain parts of the farm. The purchase of oat-free seed can reduce the spread. Second-hand bags should be carefully checked for foreign seed, and feeds containing wild oats should be isolated.

Control by cultivation

Trials have indicated that wild oats can germinate from depths as great as nine inches; generally the area of greatest seed density is the top three inches of soil, and it is here that cultivation control methods are used. The two objects of cultivation are to kill any earlier germinating wild oats, and to induce the germination of further seeds to be killed by later cultivation.

There is the drawback that cultivations aimed at preparing a seed-bed become progressively less likely to create conditions which will lead to a germination of oats below two inches. These may germinate later with the crop.

Breaking dormancy

Wild oat seed has a period of dormancy. Control could be achieved by encouraging the wild oat seed to germinate out of its normal season; that is, by breaking its dormancy. Present knowledge of the factors which will do this is not complete, but two or three useful facts have been discovered. It is known that oxygen is necessary to germinate the seed and also that the seed coat must be pierced. Obviously, cultivation, particularly of partly dried soils, will have an effect. It has also been shown that soil compaction around the seed inhibits germination. There is evidence to suggest that cold is needed by *A. ludoviciana* and that heavy frosts will often break dormancy. Some trials have indicated that soil nitrates aid germination of *A. fatua*.

The question of wild oat dormancy is a fruitful one for research. An understanding of the factors relating to dormancy could be of great assistance in designing practices for wild oat control. Meanwhile,

we must use practices which have succeeded so far in controlling the weed.

Grazing control

Grazing in stubbles should aim at preventing wild oats from seeding. Burning of stubble is an effective method of reducing wild oats in a succeeding crop. When combined with grazing and cultivation, burning is quite effective in dealing with all but those oats lying deep in the soil. Stubble burning is not usually considered to be warranted simply to control wild oats.

Crop rotation control

Several methods of crop rotations have been tried to prevent germination of wild oats and all have been successful to a degree. A sequence of crops which prevents wild oat germination for three years will eliminate all seeds in the ploughed layer. This practice is not always possible, but could be based on the use of summer crops or delayed sowing of other crops such as wheat or barley. Delaying of sowing drastically reduces wild oat infestation, but also reduces crop yields.

Best results are obtained by using a moderately long pasture phase between crops. This may be as long as six to eight years under conditions of heavy infestation. Fertilization of pastures, particularly in the establishment year, may be an important step. Similarly, crop competition induced by fertilizers may give good results. Increased seeding rates have also been of benefit. Increased fertilizer and seeding rates aimed at wild oat control should be preceded by correct cultivation practices. The benefit of this can only come from quicker germination and growth by the crop. Should the wild oats germinate first, the increased fertilizer could well favour their growth.

Chemical control

In many cases chemical control is necessary and is quite effective. While the cost of application is about £2 10s. 0d. an acre it may be preferred to extra cultivations. Nevertheless it can, at best, be regarded only as supplementary to other methods of control as it can only deal with wild oats germinating over a short period.

Two chemicals useful for wild oat control are barban and di-allate.

Barban (Carbyne ®): 4 chloro-2-butynyl-N-(3-chlorophenyl) carbamate.

Barban is a post-emergent herbicide capable of selectively inhibiting the growth of wild oats in wheat and barley. It is translocated within the plant and acts through control of the growth process. Wild oats affected show a slow darkening in colour to bluish green. They may die, remain stunted or in cases of insufficient competition, produce weak tillers which set few seeds.

Complete kills are seldom recorded, but when crop density is adequate, a kill of the oats varying from 60 to 90 per cent has been recorded. The surviving plants have been weak with few seed heads. The material is not effective against broad-leafed weeds at the rates used. Spraying with other material, such as 2,4-D to control other weeds should not take place within seven days.

Barban can cause severe skin irritation if it is spilt on to clothes or skin and not immediately removed.

Di-allate (Avadex ®): (2, 3, Dichloroallyl disopropyl-thiolcarbamate).

Di-allate is applied as a pre-emergent herbicide; that is, application to wheat and barley should be made after sowing. The chemical may be absorbed by the primary root, the coleoptile or by the husk. Although wheat and barley have a higher tolerance than wild oats to di-allate absorbed through the coleoptile, placement of the chemical above the crop seed is important.

The residual property of di-allate gives control of wild oats for up to eight weeks from sowing. It is important to spray on to an even ground surface and on a still day. Windy conditions lead to erratic spraying; hence crop damage and poor wild oat control.

The material is similar to barban in toxicity, and should be handled carefully.

® registered trade name

Barban should be sprayed at 5 oz. per acre active ingredient (2 pt. of Carbyne is recommended) for ground spraying and 4 oz. per acre active ingredient, ($1\frac{3}{5}$ pt. of Carbyne) for aerial spraying to give satisfactory control of wild oats in wheat and barley. Crop damage at these rates is not apparent, or is very slight. For ground spraying, the commercial material is mixed with from 10 to 20 gal. of water per acre; for aerial spraying the rate is 3 to 5 gal. of water per acre.

Method

Care is required with barban and, when spraying from aircraft, only experienced operators should be employed. Critical factors which require attention are flying height, volume of spray, and variety of barley or wheat. Some varieties of barley are damaged by barban; caution is necessary also when spraying new wheat varieties for the first time.

The timing of the barban spraying is most critical. Wild oats should be sprayed when they are at the $1\frac{1}{2}$ to $2\frac{1}{2}$ leaf stage. Spraying before or after this time will give unsatisfactory results.

Di-allate is applied at the rate of 1 lb. active ingredient per acre for wild oat control in wheat and barley. This rate is equivalent to 2 pt. of Avadex per acre in 7 to 15 gal. of water; aerial application is not recommended.

Method

Di-allate should be applied to wheat after sowing and then incorporated into the soil by harrowing within three hours of application. The boom can be attached to the combine to apply the spray behind the trailing harrows. Spraying before these harrows will lead to chemical accumulation due to the uneven ground surface left by the combine. Best results are obtained when the nozzles are angled forward at 45° to the vertical. Fan type nozzles operating at 20 to 30 lb./sq. in. have given good results. Harrowing depth should be one inch. Two harrowings at right angles to each other prove most effective. It is important not to incorporate the material to a depth greater than $1\frac{1}{2}$ to 2 inches in the soil.

Should I spray?

The high cost of chemical weed control, up to £2 10s. 0d. per acre, could lead to some reluctance on the part of farmers to use these herbicides. However, yield increase reports of as much as 15 bushels per acre are common and have been achieved in crops where wild oat infestation was once heavy.

Wild oat infestation is heavier in some years, even in the same paddock, than in other years. The decision to use chemicals would seem to depend on at least two factors; firstly, the anticipated degree of infestation and, secondly, the use to which the crop is to be put. Obviously in the case of a pure seed crop, chemical weed control would be a proposition even with quite low infestations. In a 30 bushel crop the cost is only 1s. 8d. per bushel—not a high price to obtain wild oat-free seed.

Some results indicate that the reduction in wild oat seed produced after spraying may reflect in a much lower infestation the following year. This suggests that the cost of spraying should be viewed on at least a two crop basis. In any case, the cost of chemicals requires only a five bushel per acre increase to compensate. Careful attention to recommended application techniques is important.

Which chemical to use

Both chemicals have advantages; Avadex has an advantage in that it is useful to control wimmera ryegrass, but requires more ground working. It does, however, provide protection from wild oats germination for up to eight weeks after application. Carbyne has the advantage that it can be applied once wild oats have germinated, but is only effective against the one germination. Wild oats which germinate after the spray are not affected.

Summary

Wild oats are typically a wheat belt weed; they are present in other crops and in pastues, but economically have the greatest

effect in reducing grain yield and quality of wheat crops. They have become widespread throughout the wheat belt. They vary in severity from year to year but always ultimately become a serious weed.

Control measures may involve a number of practices ranging through prevention of infestation, cultivation, grazing, crop rotation and chemical spraying. The effectiveness of a control programme depends on the use of careful timing and a combination of these practices.

The recent development of chemical controls has greatly increased the efficiency of wild oat control. ●

Inaccurate Soil Tests Could Cause Heavy Losses

Treatment of soil to correct "deficiencies" indicated by inaccurate soil tests could involve farmers in heavy losses.

Soil tests could not replace the experience of agricultural experts in the field, though tests were useful in supplementing their experience.

In the past 10 years several organisations have tried to help farmers by providing soil and plant tests.

Many of these tests have been soundly based, but misleading information has resulted from unsound tests.

Citrus

During a recent citrus survey conducted by the Department's Chemistry Branch, several growers asked "how much lime would be needed to correct a soil pH of between 3.5 and 4.0?"

Officers of the chemistry branch took soil samples to verify the soil pH before they made a recommendation.

Their tests showed that the soil had a pH of 6.0—well above the range of 3.5 to 4.0 indicated by a commercial test.

Had lime recommendations been based on the lower pH figures, considerable risks would have been involved.

Copper

In another case an application of copper had been recommended by a fertilizer company to combat dieback on apple trees.

Subsequent investigations showed that this dieback had been caused by poor drainage and an unsatisfactory root-stock.

In yet another case, a firm had recommended copper applications to soils where toxaemic jaundice was prevalent in sheep.

Under the prevailing conditions, applications of copper could make sheep more susceptible to the disease. ●

Practical Advantages from Mulesing at Marking

D. S. DOUGLASS

The value of Mulesing is beyond doubt, but the best age for the operation is open to discussion.

Mulesing at marking protects sheep against strike during that period of their lives when they are most susceptible, that is, from lamb to two-tooth stage. Extra mustering, jetting, crutching and handling are thus avoided.

These practical advantages were first observed on the property of Mr. A. Oates,

The Author: *Mr. D. S. Douglass, Livestock Officer (Sheep and Wool), Wentworth.*

Three of the lambs in the trial. Left: Modified Mulesed. Note width of the bare area. Centre: Not Mulesed. Note heavy staining. Right: Radical Mulesed. Note width of the bare area. Bare stump of the tail can be seen.

"Calcula Station", Orange, and led the author to do the Mules operation at marking in the Orange district in 1952. A trial of Mulesing at marking is currently in progress at Wentworth, in the Western Division, where the advantages should be even more marked than in the more intensive areas. The trial began on 10 July 1964, when the lambs were four weeks old.

In the current trial, a flock of ewe lambs at an average age of four weeks in mid July were identified, weighed and randomised into five groups with 21 lambs per group. Lambs with various groups were marked either with the knife or with elastrator rings, and were either Mulesed by the modified method or the radical method or left unmulesed as controls, as indicated in the table. The season was so dry that all lambs were early weaned in mid-August at a little over two months of age. The drought broke in the last week of August, and conditions then became ideal for fly strike. Extensive scouring of many lambs aggravated the strike.

Up to December 1964, when the weaners were about six months old, over half of each of the two unmulesed groups had been struck. In contrast, the three mulesed groups were quite free of fly strike. The lambs in this trial were run as one mob. They were neither crutched nor jetted. To avoid grass seed infestation they were shorn in mid October, after fly activity had ceased.

The table and the illustration show the treatments and strike percentages recorded in the five groups of lambs. Further observations are to be recorded.

ACKNOWLEDGEMENTS

Appreciation is expressed to Mr. A. B. Smith and his sons of "Tara Downs", Wentworth, who made this trial possible.

Treatments and strike percentages

Treatment at Marking	Percentage Struck	Number per group	Number Lambs Missing
	per cent		
Group (1) Rings only: not Mulesed ..	55	21	2
Group (2) Rings and Modified Mules	Nil	21	Nil
Group (3) Knife only: not Mulesed ..	53	21	2
Group (4) Knife and Modified Mules	Nil	21	Nil
Group (5) Knife and Radical Mules ..	Nil	21	Nil

Weed Blamed for Cattle Deaths

Cotton fireweed is the suspected cause of recent cattle deaths on highly improved pastures in the Cassilis district.

Cattle of different ages died on several properties in the area. In one herd of 400 Hereford cattle, 48 died in three months.

It is thought that poisonous alkaloids in the weed damaged the cattle's livers and led to death.

Evidence suggested that the weed was eaten in its growing stage.

Cotton fireweed normally is not eaten by stock, but many poisonous plants may be eaten by stock unexpectedly and deaths may result.

FILBERT NUT GROWING

W. A. TRIMMER

THE FILBERT NUT, or hazel nut, is one of the various species of the genus *Corylus*. For this group of nuts we also have such names as cob, lombardy, barcelona, lambert and monkey nut. The trees are all filberts, this being the common name for the genus. Nuts with husks as long as, or longer than, the nuts themselves are often called filberts while those having husks shorter than the nuts are called hazels or cobs.

In general, filberts may be described as large shrubs or low trees of deciduous habit best suited for cool climates. The nut is about half the size of a walnut, is smooth shelled, usually shield-shaped and an amber colour. It is highly nutritious, containing 15 per cent protein and 50 per cent of an easily digestible oil. The whole nut is enclosed within a husk which becomes detached at maturity.

Filberts have been studied over many years at the Department of Agriculture's Glen Innes Agricultural Research Station. It seems that they are unlikely to prove an economic commercial crop because of low yields and the fact that only about 50 per cent of nuts contain full kernels. However, they have some potential as useful home garden subjects. They could be used successfully in a hedge and, as well as producing nuts of excellent edible qualities, some varieties have considerable ornamental value.

Soil and climate

For best results a well-drained, deep, fertile soil should be selected. As fruit is borne mainly laterally on one-year-old wood, a fertile soil is necessary to produce good vegetative growth each season. The filbert is more tolerant of rather compact clayey soils than the walnut or pecan. Provided the clay is not too impermeable a clayey soil is preferred to a sandy soil. A well drained soil throughout the entire year, capable of storing plenty of moisture for use during dry periods, is ideal.

The filbert has fairly high chilling requirements during dormancy and for this reason is suited to the cool areas of the State. Heavy frosts appear to have no ill effects on the flowering parts.

The Author: Mr. W. A. Trimmer, Fruit Officer, Yanco Agricultural Research Station.

Pollination

The filbert tree produces unisexual flowers, the staminate (male) blossoms being produced in long catkins. These carry the pollen and provide pollination for the female (nut producing) flowers. These are the small, star-like blossoms that produce a number of scarlet, thread-like stigmas and are known as the pistillate (female) flowers. The flowers are usually produced on the end of the terminal growth and laterals, all produced the previous summer.

As filberts are partially self-sterile it is necessary to allow for cross-pollination by planting more than one variety. Work at Glen Innes has shown that the period of maturity with catkins and pistillate flowers does not synchronise with all individual varieties. The catkins may shed pollen before the majority of pistillate flowers are receptive, or vice versa.

Pistillate flowers appear to be receptive over a much longer period than catkins are available. Some varieties have a few flowers at any time over a period of $3\frac{1}{2}$ months, the earliest commencing in May whilst pollen is shed mostly for a period of only approximately one month.

Propagation

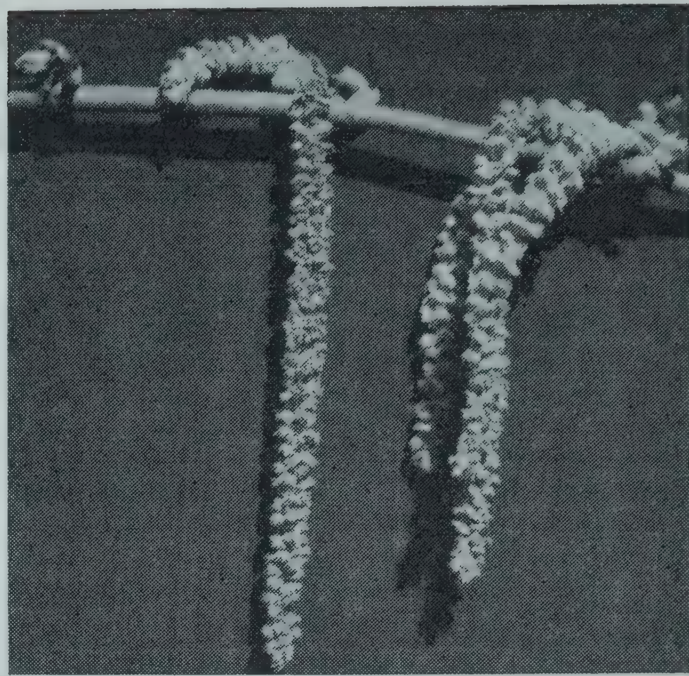
Propagation is vegetative—the roots and top of a tree are of the same variety. Mound layerage is the main method of propagation.

Suckers will form if soil is heaped up around the trunk of the tree early in summer. This soil may be pulled away during dormancy, and suckers that have formed roots at their bases can be cut off. They can be planted either in the nursery for a year, or straight into a permanent site.

Hardwood cuttings root freely in moist sand, especially if they are taken as suckers with light coloured bark at their bases. In twelve months time they may be spaced in nursery rows or planted straight out. This method is slower than the layering method, and trees are slower in coming into production.

Planting

Trees should be planted as early as possible after dormancy commences in winter.



Filbert flowers—long male catkins (centre) and small female or pistillate flowers close to lateral (left and right).

Early winter planting ensures a better start for the tree than late planting in spring, as new roots will be formed before buds start growing. With a small root system, late planted trees have considerably less chance of making good growth the first season and are more prone to sunscald.

Care should be taken when planting to prevent roots from drying out. As much as possible of the old layered wood should be pruned away before planting. Well layered trees have the roots concentrated in a small space (2 in. to 4 in.) at the basal part of the trunk. It is desirable to remove as much as possible of the original layered sucker to reduce the later development of suckers.

Roots, particularly of second year trees, should be trimmed before planting.

Deep planting should be avoided, yet the trees should be deep enough for moisture to be readily maintained around the roots.

The trunks of trees should be protected for the first two or three years after planting against sunscald injury, until the bark becomes thick and hardened. Several thicknesses of newspaper, or other readily available material which will last two or three years, is satisfactory for this purpose. Avoid wrapping too tightly as material may girdle the tree when trunk diameter increases.

Young nuts developing

Planting distances for filberts should not be much different to those for other fruit trees. If planted too close, overcrowding of growth severely restricts fruiting.

A good spacing would be 20 ft. each way, requiring 108 trees per acre. They should not be planted any closer than 18 ft. x 18 ft. (134 trees per acre).

Pruning and training young trees

The most productive trees are those confined to one strong main stem forming a headed tree like a normal fruit tree.

Trees should be pruned at planting to correspond with the loss of root system in transplanting. After planting, the tree should be headed back to a height of 18 in. to 24 in., either to a straight whip or with short laterals. The young tree will then produce many shoots, and careful selection of these should be carried out early in the season while growths are still soft, red in colour, and easily broken out. Permanent scaffold limbs, three to five in number, chosen from the new shoots as outlined above, should be well spaced up and down and around the trunk.

Many laterals will be produced between the base and tip of the scaffold limbs. Most of these shoots will be short, and only a few will be big enough to form secondary scaffold limbs. The weaker laterals, unless too numerous or badly placed, in which case they can be removed, are best left unpruned. They will become the first fruiting wood. After a few years these weak shoots will be shaded out and die, and can be removed. Leaving these weak shoots in the three largely prevents the formation of undesirable water shoots which interfere with the permanent parts of the tree.

Filbert trees are very susceptible to wood rotting, so large cuts should be avoided. Filberts are also very slow in healing over wounds. Heavy cutting will not be necessary if unwanted wood is pruned out before becoming too large.

Pruning bearing trees

Bearing trees should be pruned after the catkins have shed the pollen, otherwise pollination of many flowers will not take place.

Little pruning is required with bearing trees. It consists mainly of removing unfruitful branches and low-hanging branches that interfere with cultivation. Branches on the inside of the tree and low branches that, because of their position, are not producing catkins or pistillate buds and begin dying out, should be removed. This will make space for surrounding vigorously growing wood that will produce fruit.

Where tree growth has slowed down until only very short growth is produced, thinning out seems to have little effect on increasing tree vigour. Best results are obtained in such cases by cutting back into 3- and 4-year-old wood and thinning out all weak growth in the tree. Heading back should be done just above a lateral branch so that no dead stubs will be left. This treatment should result in a response throughout the trees, provided the heading back is uniform over the whole tree.

Where it is necessary to make cuts of more than 1 in. to $1\frac{1}{2}$ in. in diameter, the cut should be allowed to dry for two to three weeks and then Bordeaux paint applied.

Suckering

Suckering can be reduced by the use of properly grown nursery stock, by good root pruning before setting, and by proper planting practices. It will be necessary to repeat this operation several times during the

growing season for a few years, but if consistently and correctly carried out, this early attention will greatly reduce the need for much suckering in later years.

Suckering should be done when the suckers first appear and still retain a reddish colour. Soil should be pulled away and suckers broken or cut away at point of origin. Buds that are showing should also be rubbed off.

Suckering once a year has little effect on growth, and cutting suckers off at or just below ground level simply multiplies the number that grow.

General care

Filberts response to good cultural practices and, generally speaking, these should follow similar lines to those advised for other deciduous fruit trees.

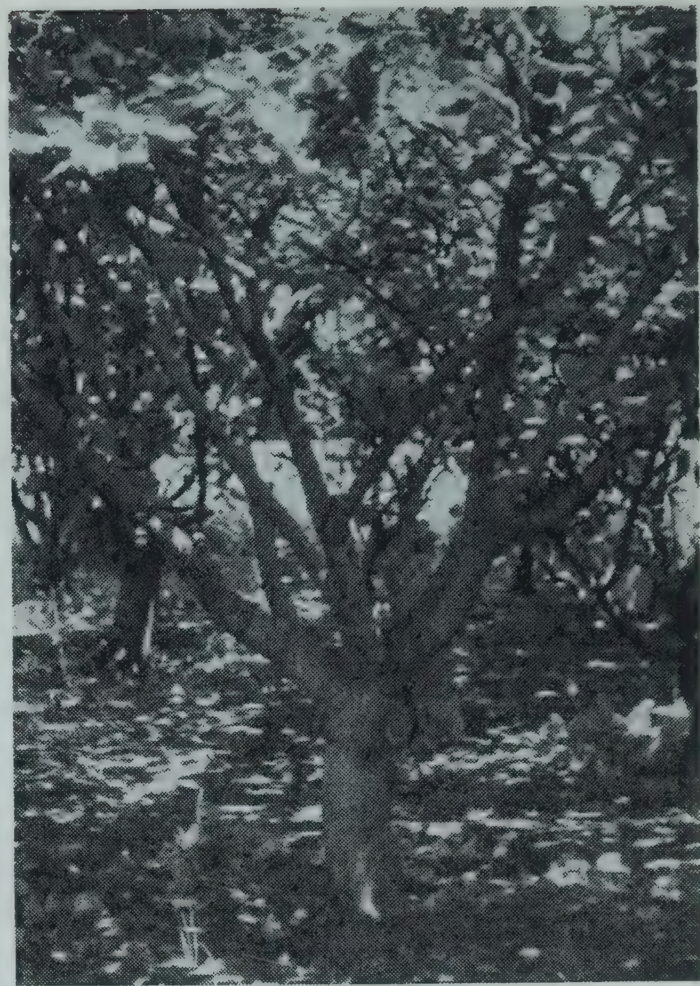
While trees are young they must not be allowed to suffer from competitions with weeds and should be carefully tended to encourage good establishment.

Cultivation to maintain high soil fertility should be followed. This will include adding a lot of organic matter to the soil.

Filberts respond to fertilizers and in the establishment years these are best used in Autumn to encourage cover crops. As trees mature, a programme including a late winter or early spring dressing as well as an autumn one should be considered. A suggested programme for tableland districts is 4 to 6 cwt. of superphosphate plus 2 cwt. of calcium ammonium nitrate, sulphate of ammonia or other pure nitrogenous fertilizer per acre as a yearly dressing for mature trees, divided evenly between spring and autumn dressings.

Harvesting and storing of nuts

The nuts must be left on the trees until they are quite ripe, at which stage the husk becomes very harsh and brittle and the nuts develop a rich, brown colour. When properly mature the nuts fall to the ground. They should be picked up frequently to avoid discolouration of the shell by weathering. After drying they can be stored.



A well-trained filbert tree—note single trunk and framework of sturdy limbs.

Nuts should never be stored in bags or deep containers without thorough drying because of the risk of mould development. They can be dried quite well by spreading in a shallow layer under cover for a few weeks, stirring frequently. If they are held for long in a dry room they tend to lose flavour, but will regain it after being held in a humid atmosphere.

Bearing age and yields

Well grown trees or bushes will produce nuts 5 to 6 years from planting, and production generally increases with age. Individual tree yields have been recorded from a block of filbert trees planted in 1937 on the Agricultural Research Station, Glen Innes. The block consisting of thirty varieties was close planted 10 ft. x 10 ft. between trees. Yields of up to 17 lb. of nuts per tree are now (twenty-seven years after planting) being harvested from the heaviest croppers.

The percentage of nuts containing kernels has varied from 40 to 60 per cent for the

A layer taken from parent tree—rooted shoots after trimming can be planted in nursery or in permanent position.

Mature nuts ready to fall to the ground

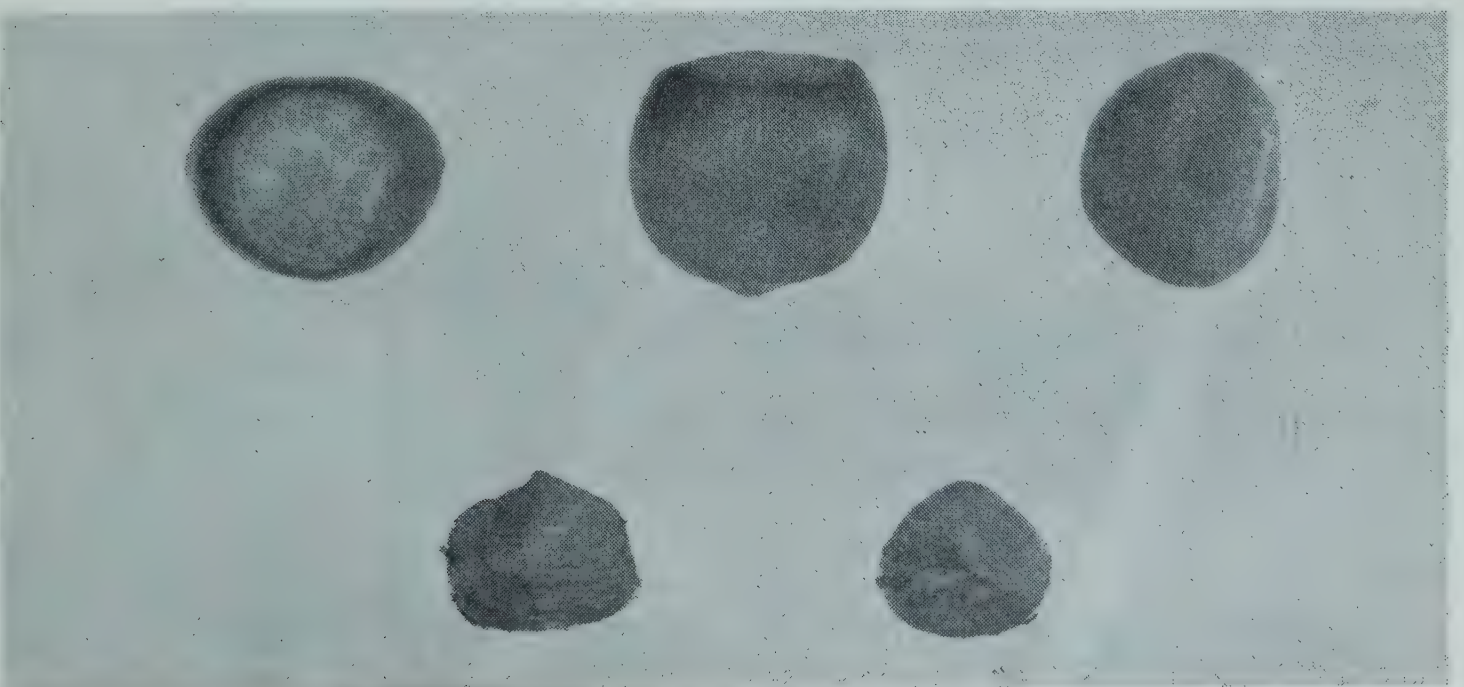
full range of varieties. There is also considerable variation in nut size, shape and colour, between different varieties—the majority of those producing the largest nuts being the heaviest croppers.

Varieties

The following varieties are recommended on results obtained at Glen Innes: Tonollo, Hemples, Atlas, Imperial de Trebizonde, Roshale, Italian, Spathe Ronde' D'affoer, Hallesche Relson, and Gros Fruit Ronde. With the exception of Imperial de Trebizonde, which has only medium vigour, the other varieties are all strong growers. All varieties produce large nuts, with the exception of Italian and Roshale. Their nuts are only small but are produced in abundance.

The period of maturity with catkins and pistillate flowers has been found to synchronise fairly well with these individual varieties. However, for best results two or more varieties should be planted together to ensure satisfactory pollination. ●

Tonollo, illustrated actual size below, is one of the recommended varieties of filbert.



Livestock Health Notes

J. S. HEALEY

SHEEP FOOT ABSCESS MAY BE SERIOUS

FOOT ABSCESS appears to be an increasingly important problem, and in some flocks it has been more damaging than footrot. Pregnant ewes in particular can be seriously affected by an outbreak. Their inability to graze because of the disease has often resulted in death from pregnancy toxaemia.

Foot abscess is caused by infection of the foot with the organism *Fusiformis necrophorus*. This organism is distinct from *Fusiformis nodosus* which produces footrot in sheep. However, *Fusiformis necrophorus* is also the cause of footrot in cattle.

Foot abscess has often proved difficult to control. There is now evidence that cattle footrot vaccine can be used to protect sheep against foot abscess. Unfortunately the length of protection given by the vaccine is at best only 3 or 4 weeks. However, one or two vaccinations could often be enough to tide a flock over the period when seasonal conditions favour the spread of foot abscess. Best results have been obtained from alum-precipitated vaccines.

Antibiotics are now being used to treat sheep with foot abscess. For satisfactory results, however, they must be administered within 24 hours of the onset of lameness. When sheep have been treated in this way, a single injection has generally sufficed. The antibiotics used have been penicillin or streptomycin.

WORM DRENCHES NOT ALWAYS AT FAULT

IF SHEEP show symptoms of worm infestation soon after being drenched, it is natural to blame the drench. However the drench may not always deserve censure. One cause of apparent inefficiency on the part of a worm drench can be the phenomenon of arrested larval development.

Normally, the larvae of most species of worms when eaten by sheep become adults within a few weeks. At times, however, these larvae enter the wall of the bowel where they can remain dormant for many months. In this condition they are protected against the action of drenches. Eventually these larvae emerge from their place of hiding and grow to adults. The cause of arrested development of worm larvae is believed to be a partial immunity on the part of the host animal. This immunity is not strong enough to destroy the larvae but is sufficient to delay their developing into adults.

Recent work at the University of Sydney has shown that the removal of adults of the small brown stomach worm (*Ostertagia* spp.) by drenching with phenothiazine can encourage the sudden emergence into the stomach of large numbers of these larvae. They then quickly come to maturity, leaving the sheep just as heavily infested with adult worms as before treatment. The small brown stomach worm is not the only species whose larvae can be retarded, nor is drenching the only factor to cause their sudden emergence.

The emergence and development of reretarded larvae are also thought to produce what has been referred to as the 'spring rise' and the 'summer rise'. These rises are sudden increases in the burden of adult worms carried by sheep. The spring rise has been found to occur in England and New Zealand and the summer rise in Western Australia.

The best safeguard against a build up of retarded larvae is the adoption of a system of husbandry and tactical drenching designed to reduce the spread of worms.

The Author: Mr. J. S. Healey, Principal Veterinary Officer (Extension), Farrer Place, Sydney.

WORM PROBLEM IN CATTLE

STRANGE HAPPENINGS on the worm front are not confined to sheep. During the last year there has been an increase in the number of adult cattle severely affected by the small brown stomach worm. Grown stock have previously been regarded as relatively resistant to worms. In the cases encountered in adult cattle, the infestations have been serious enough to cause death. A high proportion of the losses have been in bulls.

Symptoms shown have been loss of condition, and scouring. Many cases have required repeated dosing with thiabendazole before the symptoms abated. The resistance to treatment was probably attributable to retarded worm larvae as referred to in the preceding item.

If, therefore, adult cattle are found to be losing condition, and scouring, there is a possibility of worms being responsible.

UNUSUAL OUTBREAK OF TETANUS

TETANUS OCCURS from time to time in most classes of livestock. Usually the organisms which cause the disease enter through a wound.

Recently, quite an unconventional type of outbreak was reported from Victoria. In this case every one of a group of 48 heifers and steers became affected. Most showed only mild symptoms. There were, however, two deaths. Unusual features of the outbreak were that all cattle showed symptoms about the one time while none showed detectable wounds through which bacteria could have entered.

What prompted the outbreak is not fully known. However, two possible explanations have been advanced. Immediately prior to the outbreak the cattle had been eating both dry thistles and the dry stalks of broom millet. This material, and particularly the sharp spines of the thistles could readily have abraded the membranes of the stomach. It is well known that the causal organisms of tetanus are common inhabitants of the stomach and intestines. They are often present in droppings. If the membranes of the stomach had been penetrated by the roughage eaten, the way would have been open for the entry into the tissues of the tetanus organisms.

An alternative explanation is that for some reason conditions in the digestive system of the cattle became favourable for the rapid multiplication of the organisms. The number of organisms resulting could then have produced a toxin in the stomach which on absorption could have caused tetanus. This latter explanation is quite a likely one in view of the symptoms being milder than usual in most of the affected animals.

THYROID DERIVATIVES DANGEROUS

AT INTERVALS over the past decade the question of administering thyroprotein or its active ingredient thyroxine to stock, has cropped up. Thyroxine is a hormone produced in the animal body by the thyroid gland. When first marketed commercially in the Northern Hemisphere, thyroxine was hailed as a near miracle drug. It did in fact greatly increase production, particularly in dairy cattle. The response on the part of owners however became less enthusiastic when treated stock started to die from the toxic effects which the drug produced.

Recently, the C.S.I.R.O. has examined thyroxine from the point of view of increasing wool production in sheep. Pellets of thyroxine were implanted under the skin of sheep whose growth and productivity were then compared with those of untreated sheep. The experiment showed that the thyroxine treated sheep ate more feed, grew faster and produced more wool than those not treated. However, the amount of wool produced by the treated sheep per unit of feed was less than that produced by untreated sheep. Furthermore, if the extra feed required by the treated sheep was not available, the sheep died.

The effect of thyroxine is to increase the activity of most tissues and organs of the body including those concerned with digestion and utilisation of feed. If the extra feed required is available, all is well. If not, there is a risk of death. Under Australian conditions it is difficult to guarantee the continuity of feed necessary to prevent thyroxine proving toxic. ●

SUPERPHOSPHATE Reduces Swede Turnip Germination

L. H. EVANS

IN N.S.W. it is a common practice to mix swede turnip seed with the fertilizer and sow it through the fertilizer box of a seed drill. Usually, superphosphate is the only fertilizer applied. Although germination failure is rare, it is probable that there is frequently a substantial reduction in percentage germination. This escapes notice because a satisfactory number of seedlings still emerge even though low seeding rates of $1\frac{1}{2}$ to 2 lb. of seed per acre are used.

Trials were undertaken at the Agricultural Research Station, Grafton, in 1962 and 1963 to examine the effect on germination of swede turnips when the seed is sown in contact with superphosphate.

New Zealand (1958)[1] and Tasmanian (1962)[2] reports have indicated that germination is reduced.

The trials were designed to determine whether:

- Superphosphate caused faulty germination when it came in close contact with the seed; and
- The use of equal parts of superphosphate and agricultural lime would offset any adverse effect on germination.

Experimental procedure

Two experimental trials were established on March 20, 1962. In the first, the seed was mixed with fertilizer before sowing, and sown through a seed drill. The trial was laid out in four randomised blocks, each plot comprising four drill widths, one chain in length. Germination counts were made at random in 6 ft. lengths along rows selected at random.

Control plots were also established. These consisted of plots sown with sand equal in weight to the weight of the superphosphate or basic superphosphate.

The second trial consisted of single hand sown rows, 20 ft. long in randomised blocks with four replications. Each row was sown with 100 seeds, and the fertilizer was mixed with the seed just before sowing. Germinated seeds were counted and removed when the plants had reached a height of about $\frac{1}{2}$ inch.

In both trials four counts were made at intervals of three days; the first was made seven days after sowing.

In 1963 a hand sown trial only was established. The procedure was similar to that for the previous year's trial. Sowing was carried out on the 15th June, and

The Author: Mr. L. H. Evans, Agronomist, Leeton, formerly of the Agricultural Research Station, Grafton.

the variety used in all trials was Champion Purple Top.

Results

The following table shows the total number of plants which germinated from the original 400 seeds in each treatment of the 1962 and 1963 hand sown trials.

The drill sown trial showed marked variability between rows in the same treatments. Though counts showed similar trends to the hand sown trials, differences were non-significant. Because it appeared less reliable than the hand sown trial it was discontinued in the second year.

It is apparent from the results that the use of superphosphate in close association with swede turnip seed is responsible for impairment of germination. Figures for time of emergence of the seed were not analysed. However, the percentage emergence of seed sown in close contact with superphosphate at the first and second counts was considerably lower than the corresponding percentages for the control plots and those where a basic superphosphate was used. This would suggest that in addition to impairment of germination there was also a delaying influence.

The effect of superphosphate in reducing germination was largely overcome by using equal parts of lime and superphosphate premixed before sowing.

Because of the small cost of seed and the low sowing rates used, it would appear that any impairment of germination from mixing seed and superphosphate could be more conveniently and economically overcome by increasing the sowing rate rather than by using a basic superphosphate.

However, the possibility of delayed germination, which could cause reduced vigour in the resultant plants, must be considered as well as the possibility of uneven germination or germination failure, should adverse conditions occur at seeding time. These effects would be specially likely to occur with unseasonal sowing and when sowing is made in a roughly prepared seedbed.

It is suggested that where seeding is carried out under conditions which are not ideal and the seed is to be sown through the fertilizer box, a basic superphosphate should be used in preference to superphosphate alone.

When basic superphosphate is to be used, the lime and superphosphate should be mixed several days beforehand. This will allow time for the full neutralization of the acid superphosphate, eliminating the effects harmful to germinating swede turnip seed.

References

(1) Hadfield, J. W. (1958)—*Arable Farm Crops of New Zealand*; 200.

(2) Lamp, C. A. (1962)—Improved Turnip Crop Establishment, *Tasmanian Journal of Agriculture*, **33**, (1); 42-48.

Germination of Swede Turnip Seed Under Various Fertilizer Treatments

Treatment	Drill Sown Trial 1962	Hand Sown Trial 1962	Hand Sown Trial 1963
Lime 2 cwt. per acre + superphosphate, 2 cwt. per acre	120	209 (46·3°)	239 (50·6°)
Superphosphate, 2 cwt. per acre	90	154 (38·2°)	185 (42·8°)
Control (sand, 2 cwt. per acre)	125	286 (56·8°)	246 (51·7°)
Difference for significance	..	11·6°	5·4°

(Angular transformations were used in the analysis of variance).

Donations and Loans to the Department of Agriculture

FROM 1 JULY TO 30 SEPTEMBER 1964

To the Mid Western Region:

Australian Fertilizers Ltd.	186 lb. bag of superphosphate—for use in prune and cherry fertilizer trials.
Young Cool Stores	224 lb. (2 bags) of calcium ammonium nitrate—for use in prune and cherry fertilizer trials.

To the South Coast and Tablelands Region:

Goulburn Broadcasting Co. Pty. Ltd.	Continued servicing of tape recorders, and construction of ancillary equipment.
Wollogorang Pastoral Co. Pty. Ltd., Bredalbane	Materials and facilities for pelleting legume seed.

To the Northern Region:

Dow Chemical (Aust.) Pty. Ltd.	$1\frac{1}{2}$ pt. Tordon ®.

To the Western Agricultural Region:

Henry H. York & Co. Pty. Ltd.	8 lb. 5% Di-syston granules.
Geo. C. Warner Laboratories Pty. Ltd.	4 fl. oz. Kelthane 30. 2 fl. oz. Kelthane 50. 6 oz. Kelthane $18\frac{1}{2}$% wettable powder.
May & Baker Pty. Ltd.	1 gal. 2, 4, —DB.
Dalgety & New Zealand Loan Ltd.	2 lb. Dixie crimson clover seed. 2 lb. Marrar sub. clover seed.
Orange Producers Rural Co-op. Soc. Ltd.	1 lb. sodium molybdate.
F. H. Faulding & Co. Ltd.	1 doz. 35 grm. tubes of Phonix " Pig Pas ".

To the Agricultural Research Station, Glen Innes:

Elanco Products Co.	1 lb. Trefmid for tobacco research
Lanes Pty. Ltd.	1 qt. Treflan $2\frac{1}{2}$ lb. Dymid for tobacco research

To the Agricultural Research Station, Grafton:

Crookes Laboratories, Ltd.	1 lb. Framomycin feed additive. 20 ml. Ferrofax for treatment of iron deficiency. 15 ml. Crookes injection of stilboestrol dipropionate. 30 capsules Ferrosul. (donated in connection with Pig raising).

To the Horticultural Research Station, Narara:

Gosford Agricultural & Citrus Assoc.	3 tins bituminous paint (value £8). Cartage of 40 yards soil from Somersby to Narara—(value £40). for interior painting and filling of concrete pots used for Nutrition Trial with Valencia Orange trees.

To the Board of Tick Control, Lismore:

Amada Pty. Ltd.	1 jar of protective cream.

To the Research Stations Branch:

Lightburn Ltd.	24 booklets on concreting, retail price 10s. each. These booklets were forwarded to the Agricultural Research Station, Yanco.

To the Division of Plant Industry:

Potash (A/asia) Pty. Ltd.	35 cwt. muriate of potash for U.P.S.E.T.
Colonial Sugar Refining Co. Ltd.	3 tons gypsum for U.P.S.E.T.
Eli Lilly (Aust.) Pty. Ltd.	1 qt. Trifluralin herbicide for weeds research.
Boots Pure Drug Co. (Aust.) Pty. Ltd.	1 pt. Chloroprop herbicide for weeds research.

To the Biology Branch:

Henry H. York & Co. Ltd.	2 lb. Dexan for experimental work on Phytophthora and Pythium spp.
Lane's Pty. Ltd.	$\frac{1}{2}$ gal. Nosco weedkiller. 1 qt. Nockweed D. For grape dead arm spray trials.
Colin Campbell Pty. Ltd.	10 lb. Chlorosoil (20% P.C.N.6). for experimental work on control of Armillaria root rot. 2 lb Mangan Curit. 2 lb. Copper Curit. For grape downy mildew spray trial.

® registered trade name.

To the Agricultural Research Station, Narrabri:

Union Carbide Aust. Ltd.	1 pt. experimental herbicide HC 22463—45%.
Elanco Products Ltd.	½ gal. " Treflon " herbicide.

To the Agricultural Research Station, Cowra:

I.C.I. of Aust. & N.Z. Ltd.	2 pt. Agral (wetting agent) ®. 4 pt. Paraquat (weedicide) ®.

To the Agricultural Research Station, Yanco:

Agserv Industries Pty. Ltd.	2½ lb. " Tenatrol " herbicide. Qty. of fungicides and weedicides.
Drug Houses of Aust. Ltd.	Display materials chemical samples. 1 only pressure drenching gun.
I.C.I. of Aust. & N.Z. Ltd.	Pesticides in small bottles.
Geigy Agric. Chemicals Ltd.	2 lb. " Gesaprin " ® Simazinc. 2 lb. " Gesaprin " Atrazinc.
Ciba Co. Pty. Ltd.	2 lb. C 2059, ½ lb. C 3470 } experimental herbicides.
Lanes Pty. Ltd.	4 lb. P8NB—Captan 10% ®. 1 qt. Tryburalin E.C. ®. 8 oz. Spergon ®.
James Hardie & Co. Pty. Ltd.	1 only demonstration board and samples.
Monsanto Chemicals (Aust.) Ltd.	6 oz. experimental herbicide CP 31393.
Union Carbide Aust. Ltd.	1 qt. experimental herbicide VC 22463.

To the Royal Botanic Gardens:

The Manager, Government Stores Department	Original water colour painting, by R. K. Harris, of the Pioneer Memorial Garden, the Garden Palace Grounds, Sydney.
The Smithsonian Institution, Washington, U.S.A.	321 photographs of type specimens of ferns.
Miss J. M. Baldwin, Springwood	Three film strips of Protected Plants of N.S.W. These strips were produced by the Visual Education Centre of the Department of Education from Miss Baldwin's colour photographs. A small descriptive booklet accompanied the film strips.

To the Division of Science Services:

Geigy A/asia Pty. Ltd.	GEIGY Scientific Tables, 6th ed., 1962.

To the Hawkesbury Agricultural College:

Southern Limestone Pty. Ltd.	5 bags agric. lime, 5 bags fine lime, 3 bags shell grit } poultry feed supplement. 4 bags limestone—student demonstration.
Mr. C. Moon, " Avon Downs ", Burren Junction	2 dwarf calves, Hereford (male and female) for demonstration purposes (student instruction).
Nightingale Chemicals (N.S.W.) Pty. Ltd.	40 lb. T.C.A. herbicide for trials and general use (grass control).
Riverina Stock Feeds Ltd.	8 Protoblocs (stock feed supplement)—student instruction.

To the Chemistry Branch:

Henry H. York & Co. Pty. Ltd.	1 winchester of Dimethylformamide.
Chemical Materials Ltd.	4 samples of emulsifiers and cresylic acid.
Blythe Chemicals Ltd.	1 sample Rogor ® (technical).
Stauffer Chemical Co. (Aust.) Pty. Ltd.	1 oz. analytical grade Trithion ®. 1 oz. Imidan ® technical.
Australian Abrasives Pty. Ltd.	Test abrasive wheels for barley pearler.
Mungo Scott, Pty. Ltd.	100 lb. control flour.
McCorquodale Bros. Pty. Ltd.	100 lb. control flour. Leather belting.
D. E. Taplin Pty. Ltd.	Manufacture of mill balance weights.

To the Poultry Research Station, Seven Hills:

Meggitt Ltd.	1 bag soymeal comparison for chick feeds.

To the Division of Information Services:

Wilcox Moffiin Ltd.	1 boom spray attachment.
Simpson Pope Distributors (N.S.W.) Pty. Ltd.	1 rainwave garden sprinkler.
Broons Containers Pty. Ltd.	125 composite banana cartons, 14 in. 25 composite banana cartons, 13 in.
Caltex Oil Pty. Ltd.	88 gal. banana misting oil PD.82A.

RESEARCH SECTION

RESEARCH PARS

PAPER

SURVIVAL OF CATTLE TICKS

THE DIRECTOR of the Cattle Tick Research Station, Wollongbar, Dr. R. N. McCulloch, and Research Officers, Mrs. J. A. Curnow and Mr. I. J. Lewis, are studying the life history of the cattle tick to provide information about the possibility of eradicating ticks in New South Wales and of the possible spread of the tick if control measures were relaxed. The programme was commenced in 1962. Results of the work have already added to the knowledge of the non-parasitic stage of the cattle tick. They have shown that, in favourable situations, ticks can develop throughout the winter at Wollongbar. In unfavourable situations the chances of survival are lower than was originally suspected. Ticks survive the winters best on unshaded pastures on north-easterly slopes.

This confirms the long-held view (on which doubt had been cast in recent years) that areas suitable for winter development of cattle tick occur well to the south of the present limit of tick infestation. Relaxation of control measures could thus have serious results for the cattle industry in other parts of the State. Dr. McCulloch hopes that by early 1966 it should be possible to define fairly precisely the southern limit of environments suited to the tick.

One possible reason for the failure of the 1956-7 eradication campaign in New South Wales was that the cattle tick had the capacity to live away from the cattle for up to 15 months, and so outlast the eradication campaign. Life history studies have shown that this possibility is mostly unlikely. The Station now has accurate records from six exposure sites at different locations, and over 1,000 engorged females and their colonies of young have been observed at each site each year. The longest recorded life of the last larvae alive in a colony has been 7½ months. These studies will be continued at the six sites at present being used and at other sites in a variety of climatic and topographical situations. Recordings of air and soil temperatures will be used in conjunction with the observations to assess the effect of environment on the length of life. It may take another two years to get the complete history of the non-parasitic life of the cattle tick in this country close to the southern limit of its range. ●

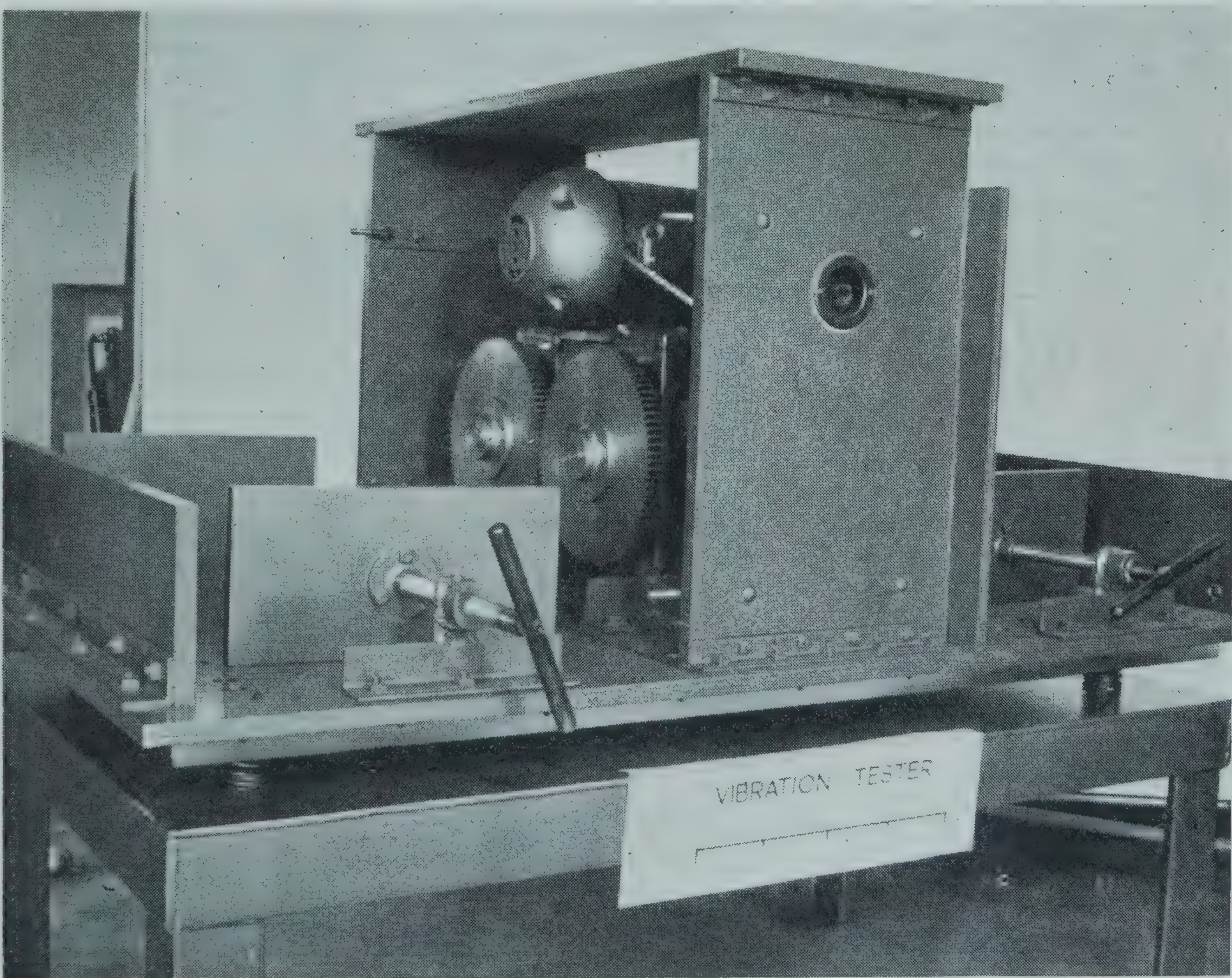
DAMAGE TO BANANAS IN PACKING AND HANDLING

THE DAMAGE CAUSED during transport and storage of bananas has been assessed in the past by subjective examination of the fruit when it reaches the market. A series of trials now in progress at the Tropical Fruit Research Station, Alstonville, will more accurately determine the influence of different packs and treatments, to evolve means of reducing damage.

Containers and packs are being compared, using machines to simulate the vibration and impact that occur during transport. Preliminary results are promising. Simulated transit allows standardised treatments, not always found in large-scale transport trials, to assess the suitability of different containers and packs.

Now that cool rooms and ripening rooms are available at the Station, containers are being studied in relation to external low and high temperature conditions and artificial ripening. Methods of stacking and ventilation as well as the design of the container are likely to affect quality.

These investigations are being conducted for the Banana Research Advisory Committee and are supported with funds contributed by the Commonwealth Government and the Australian Banana Growers' Council. ●



Vibration tester used in simulated transit tests for evaluating containers and packs for bananas. Constructed by C.S.I.R.O., Division of Food Preservation, North Ryde.

—Photo by courtesy of R. Atkins, C.S.I.R.O.

SEED YIELD OF WHITE CLOVER VARIETIES AT GRAFTON

VARIETIES particularly suited to an environment may emerge and become dominant in a native or naturalised pasture species. These locally evolved varieties have one or more characteristics that give them advantages in survival or in competition with other varieties or species. Their survival or competitive advantage does not necessarily mean that they would be better than others as pasture plants. For example, drought resistance would help a variety to become dominant, but so would unpalatability. Comparisons with other varieties are necessary before the potential value of a local selection for pasture sowings can be assessed.

At Grafton Agricultural Research Station, G. Wilson, Agronomist, has included a local variety in a comparison of white clover seed production from plant introduction nursery rows. The table shows seed production as grams per twenty feet of row from two introductions, commercial Ladino and the local variety. The local variety has a smaller leaf than the other three, but besides high seed yield it appears to have good winter-spring productivity under the nursery conditions.

In most years winter rainfall is adequate for white clover on the beef areas of the north coast, but in a winter drought only plants in favoured areas may survive. If a heavy seeding variety is used, regeneration of the pasture after a drought is more likely. Mr. Wilson will further test the local white clover variety to determine its other characteristics. ●

White clover seed production, Agricultural Research Station, Grafton

	Variety			
	Tribbiano C.P.I. 16136 (from C.S.I.R.O., Qld.)	G.E.F. Israel C.P.I. 15648	Ladino (commercial)	Local selection
Yield grams per 20 ft. row*	179	177	16	2098

* 2098 grams per 20 feet of row with rows 4 feet apart is equivalent to one ton of seed per acre.

The Effect of Temperature on Yield and Continuity of Fruit Supply of Direct Seeded and Transplanted Tomatoes

J. B. SUMEGHY

SUMMARY

Transplanting and direct seeding were compared as methods of establishment for canning tomatoes in a trial at the Agricultural Research Station, Yanco. Transplanting gave a higher mean yield of first grade fruit for the season; for four of the eight planting dates, transplated plots yielded more fruit than the corresponding direct seeded plots. Yields at successive harvest periods showed that transplanting gave higher yields than direct seeding early in the season (late December and in January). There was little difference in yield between the two establishment treatments at later harvests.

The mean temperature in the month before the first picking from a crop was the main influence on yield and continuity of production. When yields of transplanted and direct seeded plots were related to four groupings of mean monthly temperatures in the month before the first picking, the apparent effect of temperature on yields was almost linear. The lowest temperature grouping (66° to 70°F.) was accompanied by the highest yields.

SINCE ITS ESTABLISHMENT during the second world war, the practice in the tomato canning industry on the Murrumbidgee Irrigation Areas has been for growers to transplant seedlings supplied by the cannery. Since 1960 there has been a marked increase in the annual acreage sown for canning. Direct seeding in place of transplanting could make the crop more attractive to potential growers. Apart from labour, the purchase of seedlings for transplanting has always been costly.

A trial at the Agricultural Research Station, Yanco, during the 1960-61 season compared yields, commencement of maturity, and continuity of fruit supply from transplanted and direct sown tomatoes for canning.

Continuity of supply is important in crops grown for processing. A series of sowings was designed to allow for comparison of yields and continuity of production from different sowing dates as well as the comparison between transplanting and direct seeding.

Temperature affects the yield of tomatoes. Smith (1932) found that high temperatures resulted in blossom drop three days later and that low humidity, hot dry winds and low moisture also increased this shedding of flowers. Frequent periods of high temperature and prolonged low humidity are normal from December to early March in the M.I.A.

METHOD

Design

The randomised design consisted of six replicates of each of eight sowings for each of two methods. Plot size was 4 feet x 25 feet with 10 plants spaced at intervals of 2 feet 6 inches in the plot.

Sowings

Variety K.Y.1., the standard variety for processing, was used in all treatments.

Eight direct sowings and simultaneous transplantings were made in the field at about fortnightly intervals from 1 September, the last being on 15 December.

Seed for the transplanted plots was sown in seed boxes eight weeks before transplanting. Seedlings were raised in the glasshouse with the temperature maintained at 65°F night and 80°F day, to ensure uniform seedling size for transplanted treatments at all sowing dates. Boxes were removed from the glasshouse one week before transplanting to harden off the seedlings.

Direct sowings were made

The Author: Mr. J. B. Sumeghy, Senior Agronomist, Agricultural Research Station, Yanco.

Table 1. **Mean monthly maximum, mean monthly minimum and monthly average* temperatures—September 1960 to April 1961 and 30 years average.**

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1960-61 mean monthly max.	62	72	76	86	89	89	82	73
1960-61 mean monthly min.	44	48	50	61	66	63	58	55
1960-61 monthly average	53	60	63	74	78	76	70	64
30 years mean monthly max.	68	74	81	86	90	87	82	73
30 years mean monthly min.	42	48	53	58	61	60	56	48
30 years monthly average	55	61	67	72	75	74	69	60

* The monthly average temperature is the average of the mean daily maximum and minimum temperatures for the month.

with a Planet Junior seed drill, placing about twelve seeds per foot at a depth of ½ inch. Seedlings were thinned to 2 feet 6 inch intervals when they were 6 inches high.

One week before sowing or transplanting a fertilizer mixture of 3:2 superphosphate and sulphate of ammonia was applied at the rate of 5 cwt. per acre in the centre of the plot 4 inches below the soil surface.

Culture

During the trial period, plots were cultivated four times and hand hoed three times to maintain tilth and control weeds. The trial was furrow irrigated, water being applied at weekly intervals. Plots were sprayed weekly, using a motor driven portable mister, with a mixture of DDT, zineb and sulphur to control spotted wilt, late blight and insect pests.

Temperature recordings

Temperatures were recorded at the Research Station about ½ mile from the plots with an automatic weekly temperature recorder. Mean monthly maximum and minimum and monthly average temperatures for the trial period and the 30 year recordings are shown in table 1.

Table 2. **Total yields of first and second grade fruits from the eight sowings of direct seeded and transplanted plots**

	First grade (ton per acre)		Second grade (ton per acre)	
Planting or Sowing Date	Transplant	Direct	Transplant	Direct
1-9-1960	10·26	9·01	4·73	4·87
15-9-1960	10·45*	8·62	4·51	4·54
4-10-1960	7·29*	5·49	3·22	2·84
14-10-1960	7·80*	5·52	3·98	3·81
1-11-1960	7·35*	5·47	3·61	3·02
15-11-1960	5·40	4·49	3·06	1·89
1-12-1960	6·70	7·44	3·15	2·27
15-12-1960	9·95	8·46	2·47	2·81
Mean	8·01*	6·81	3·59	3·26

* Significant difference $P < 0{\cdot}05$

Harvest

Eight harvests of fully ripe fruit were made from each treatment at weekly intervals commencing when the first tomatoes were mature in the particular treatment. Fruit was graded: grade 1 was tomatoes free of sunscald, green shoulders, skin splitting and insect or disease damage, and that were larger than two inches in diameter; grade 2 was other fruit harvested.

RESULTS AND DISCUSSION

Yield differences between direct seeded and transplanted plots

Transplanting gave a higher mean yield of first grade fruit than direct seeding. The yields of transplanted and direct seeded plots for each sowing date are recorded in table 2 with the yields calculated as tons per acre. The yields of first grade fruit from plots transplanted on four dates from 15 September to 1 November were higher than direct seeded treatments sown on those dates. Differences between treatments were not significant for sowings later than 15 November. In no case was the yield of the direct seeded treatment significantly higher than that of the corresponding transplanted treatment.

There were no significant differences between the quantities of second grade fruit.

Yields at the same harvest periods

The comparison of yields of transplanted and direct seeded treatments *maturing* at the same time is the most commercially relevant in this trial, despite the fact that the comparison is between yields of plants sown on different dates.

From the first harvest (fourth week of December) until the first harvest in February, transplanted plots yielded much more fruit than direct seeded plots except for the fourth January harvest (figure 1). From the second harvest in February until the fourth harvest in March there was little difference in yield between the planting treatments. During April the direct seeded plots out-yielded the transplanted plots because by that time the transplants had reached the end of their economic productive life.

It would seem that during January, higher yields from a given area of canning tomatoes could be obtained from transplanting, but that thereafter method of establishment would not significantly affect the quantity of fruit available.

The effect of temperature

Fruit matured about one month after fruit setting began. Figure 2 shows, for each treatment, (a) the mean temperature for the month before the first

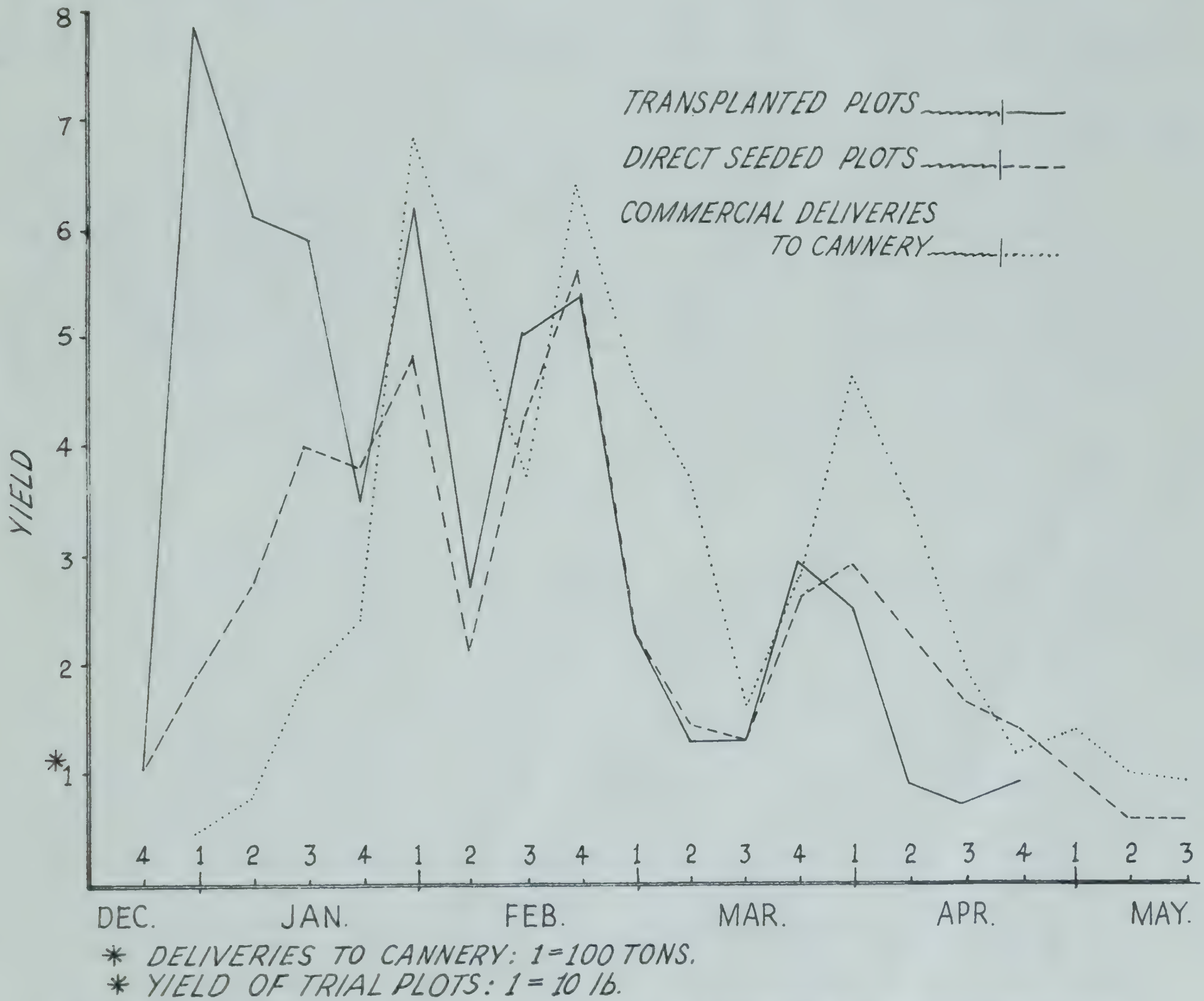


Figure 1.—Weekly variation in fruit supply—yields of transplanted and direct seeded plots and deliveries to the cannery from commercial crops. The figure does not show the full producton of the commercial crops for late December and early January because, during that period, some of the fruit was sent to the markets and not delivered to the cannery.

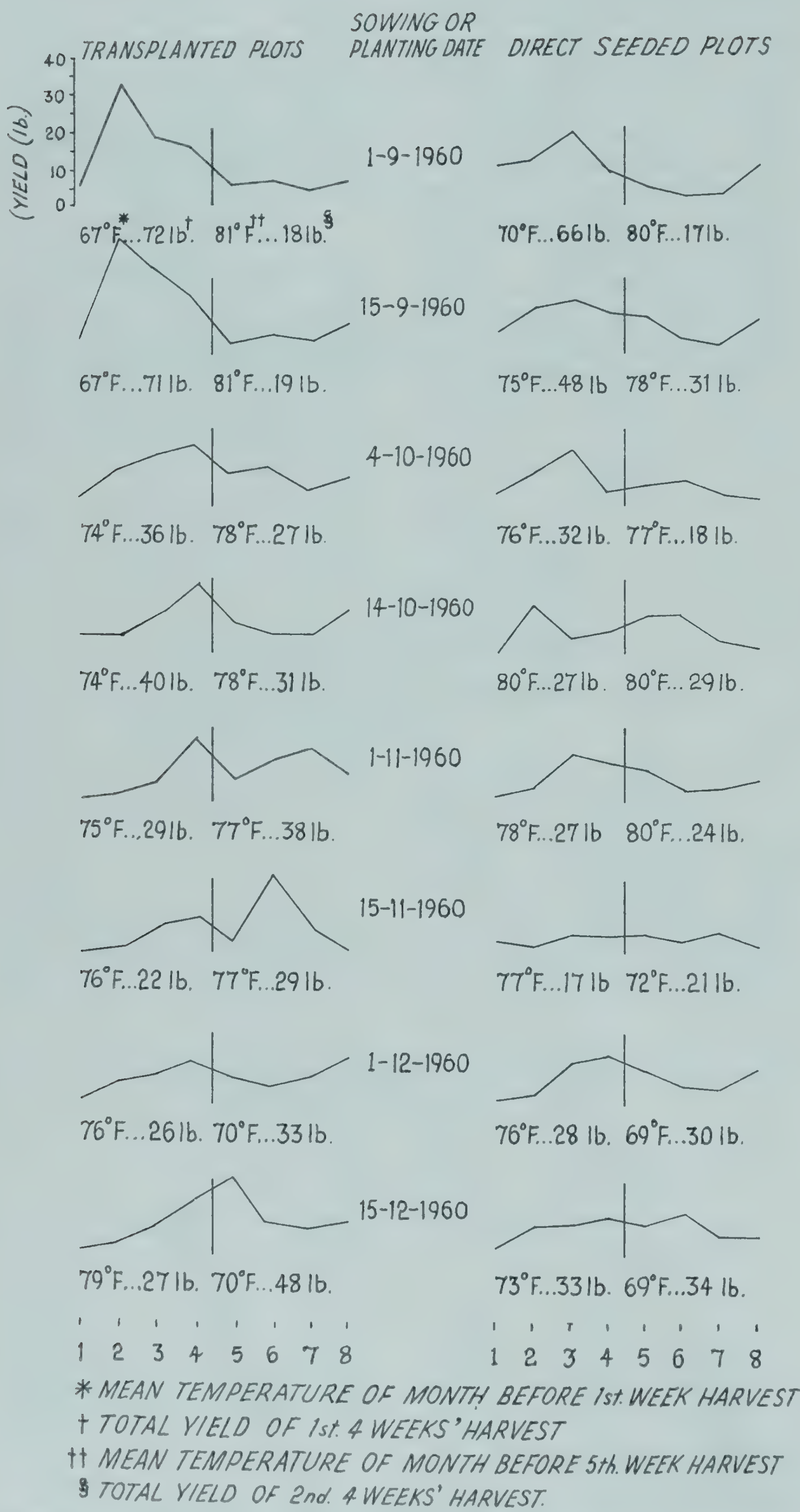


Figure 2.—The effect of temperature on yield. Yield at the eight harvests for each treatment with total yields for harvests 1-4 and 5-8 related to mean temperatures for the months preceding the first and fifth harvests.

picking and yields from the first four pickings and (b) the mean temperature for the month before the fifth picking and the yields for the fifth to the eight picking. With the exception of the treatments transplanted on 1 and 15 November, lower mean temperatures in the month before picking corresponded with higher yields.

When mean yields of transplanted and direct seeded plots are related to four temperature groupings in the month before the first picking (66-70°F, 71-75°F, 76-80°F and 81°F or higher) the apparent temperature effect on yield was almost linear (figure 3).

During the 1960-61 season 500 acres of tomatoes were grown under contract for the cannery. There were three deliveries of seedlings to the growers—in the third week of September, the second week of October and the first week of November. The first delivery included seedlings for 80 acres of Tatura Dwarf Globe. The remaining 420 acres were of the K.Y.1. variety. Tatura Dwarf Globe is similar in growth habit to K.Y.1. The close correlation of the reaction to temperature of the commercial and two experimental treatments is shown in figure 1.

Temperature affects the growth of tomatoes as well as fruit set and maturation. The first harvests from transplanted plots were from 12 to 29 days earlier than from corresponding direct seeded plots. Seedlings transplanted during September made very little growth until the middle of October, but then developed into large plants and set fruit abundantly. With later transplantings, made during October and November, higher temperatures induced earlier

flowering and prevented the development of large plants before fruit setting commenced.

This effect of temperature was more noticeable in the direct seeded treatments. Seed took two weeks to germinate during

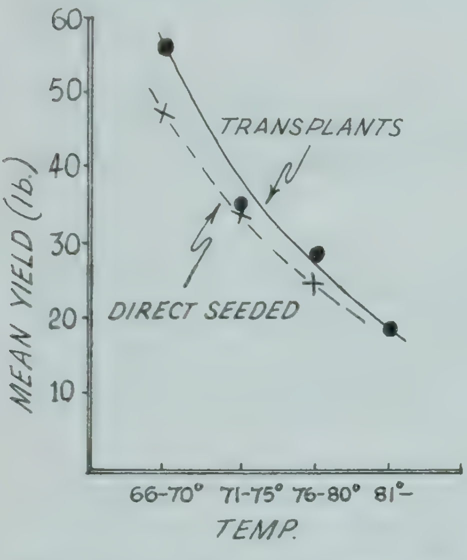


Figure 3.—Yield related to temperature groupings. Mean yields related to four mean temperature groupings (66°-70° F, 71°-75°F, 76°-80°F and above 81°F) of the month before harvest showing the fall in yield with increasing temperature.

September and October and one week during November and December. These plants reached the flowering stage later than those in the transplanted treatments and a greater proportion of flowering and fruit setting occurred while temperatures were unfavourably high. Consequently, the yield was smaller.

CONCLUSION

Direct seeding is not as satisfactory as transplanting in the production of tomatoes for canning on the M.I.A. Direct seeded plants develop too slowly, and flowering is delayed until temperatures are so high that fruit set is reduced. Direct seeding may be as satisfactory as transplanting in the later part of the season when production from both transplanted and direct seeded crops is reduced by high temperatures during fruit set. But production from late crops, however established, is inferior to that from crops established earlier in the season.

Direct seeding of tomatoes on the M.I.A. is no better than transplanting in ensuring continuity of fruit supply in January to March. Continuity of supply could be improved by increasing plant density in crops that will flower in periods when high temperatures are expected (unpublished data).

In this experiment the effect of temperature in the month preceding fruit maturation was clear. The results appear to agree with those of Smith (1932) who found that high temperatures were reflected in increased blossom drop three days later. In this trial high temperatures were reflected in reduced yield one month later. The lowest mean monthly temperature (67°F.) was followed by the highest production.

Reference

Smith, O. (1932)—Relation of Temperature to Anthesis and Blossom Drop of the Tomato, together with a Histological Study of the Pistils. *Journal of Agricultural Research*, **44** : 183–190. ●

Herbaceous Borders for Your Garden

R. H. ANDERSON

THE TRUE HERBACEOUS BORDER is not often seen in Australian gardens. It is more common in English ones—and is often seen in those colourful pictures of English country cottages.

Herbaceous perennials, however, are very useful in all gardens. Strictly speaking they are plants with perennial roots, but with tops which die to the ground each year. However, I am including perennials such as shasta daisies, begonias, Rudbeckia and so on.

A well-grown herbaceous border is a delight to the eye and contains a wide range of colour, texture, and form. Traditionally, it is usually sited with a wall, trellis or hedge as background. When well placed in open ground or lawns it is equally attractive.

The border should be about 4 ft. 6 in. wide and with a path at the back to prevent trampling the bed. Plants of varying height, flower colour and texture are used to give a massed effect, but must create a natural picture. In a general way the tallest plants are arranged at the back of the border, gradually scaling down to small plants at the edge. This arrangement should not be followed too rigidly as it could give a too uniform and dull effect—a painful symmetry.

Taller plants should be used here and there to break up the symmetry, with an occasional one well to the front.

The border aims at a mass of colour, but this needs careful planning. Large splashes of different colours are best, and the tints should merge gently into each other. When using reds start with pale pink and work up to vivid red and then back to pink. Then follow the same idea with purples, blues and yellows.

Care is needed in associating the colours. Pink goes well with lilac, and so on. Some strong colours can be associated without going through the graduations, for example, deep blue with gold. White is useful, going with both strong and pale colours, but should be used sparingly as otherwise the border will look patchy.

Don't forget if planting for colour that the plants chosen should flower at the same time.

Thorough soil preparation is necessary. Deep cultivation is required as the plants will be there for a long time and the competition is keen.

Fairly close planting is necessary as there should be no bare ground.

Plant in groups of four to nine, depending on the size of the plant—small plants are spaced about 8 in. apart, mediums 15 in. and larger ones 2 ft. apart.

Make sure that the varieties chosen are really suited to the conditions of the planting site. Don't try to force in plants which attract your fancy, but are not suitable for your soil and climate. ●

The Author: Mr. R. H. Anderson, former Director and Chief Botanist, Royal Botanic Gardens, Sydney (now retired).

A See-at-a-glance Storage Unit You can Make

Nina Martindale

Maximum storage efficiency in the home can be achieved in many ways through skilful use of space.

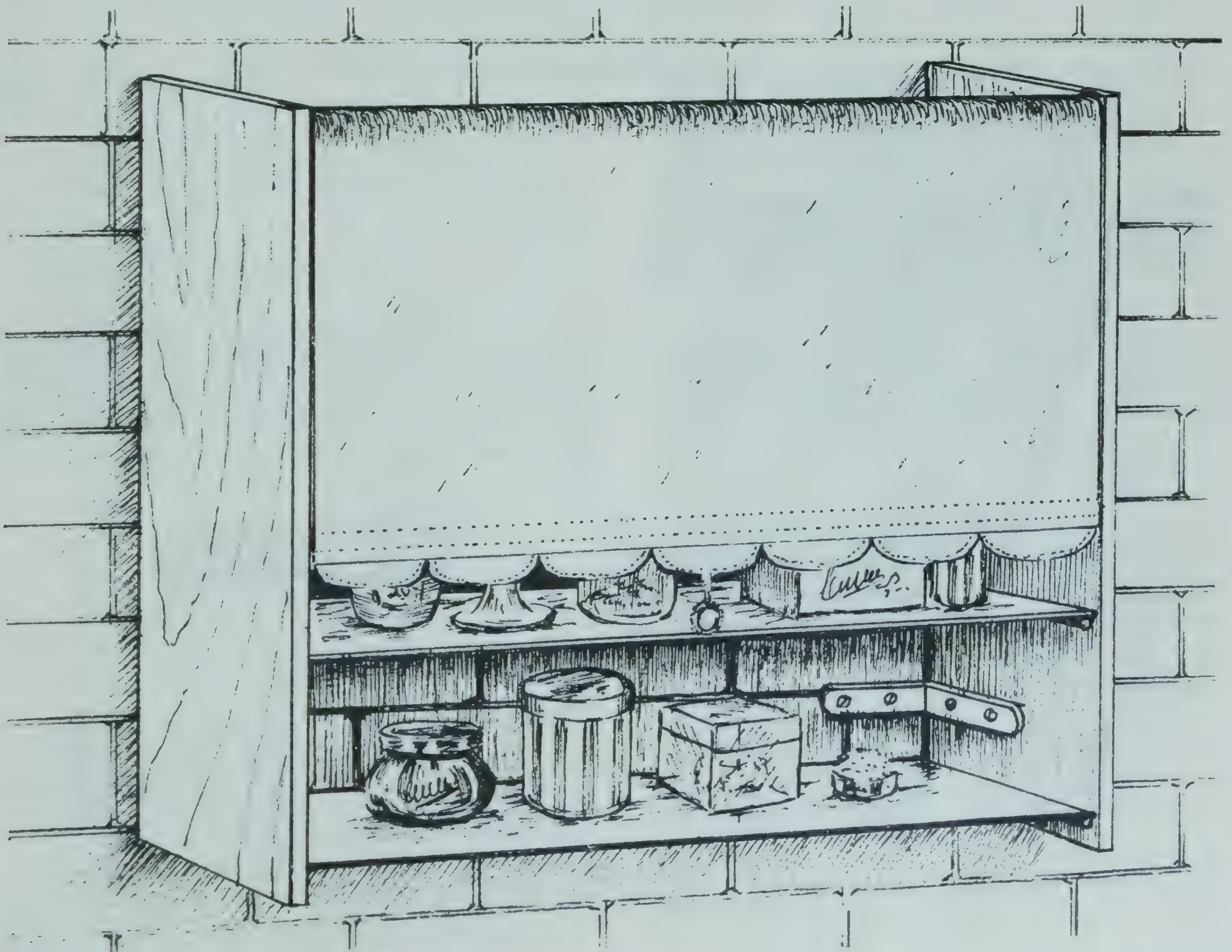
One of the most useful kitchen space savers, that anyone can make, is see-at-a-glance storage shelving. Simple and cheap, it can have many uses for storage of family out-of-children's-reach odds and ends.

The shelving is made from two lengths of wood ($\frac{1}{2}$ in. x $3\frac{1}{2}$ in) or pegboard, a plastic roller blind with attachments, four angle brackets, several "hook-on" shelf supports, and strips (as many as are needed) of wall-board for moveable shelving.

Constructed to any width required, or width of the small plastic blind, its height is determined by the arm's length reach of the householder who will be using it.

Two pieces of wood or pegboard are attached to the wall by corner brackets to

The Author: *Mrs. Nina Martindale, Senior Extension Officer (Women's Services), Farrer Place, Sydney.*



form the two sides of the storage unit. The plastic blind, with its attachments, is screwed at the top. When the blind is down, it neatly hides the storage contents from view.

Wallboard strips for the shelving are cut 3 in. wide. The shelves rest on top of hook-on supports if the sides are of pegboard, or strips of beading, suitably attached, if plain wooden sides are used. The distance between shelves, and the number required depends on the size, height, and also number of jars, tins or bottles to be stored.

For the housewife's convenience, one of these storage units can be attached to the wall close to the food preparation area or the stove in the kitchen; another one could be used in the garage or shed where insecticides and garden supplies are stored.

If the storage unit is wide, wallboard shelving may require a centre support to prevent sagging. This can be done by backing the wall area of the storage unit with a strip of pegboard, wallboard or plywood.

Any handyman can easily work out several ways to construct the see-at-a-glance storage unit—even pieces of scrap floor boards can be used for shelves.

The unit can be easily attached to doors and sides of existing cabinets and does not necessarily require the roller plastic blind.

Here are some of the items that can be stored in the unit: Medicine and dangerous drugs; first aid equipment; sewing odds and ends for home dressmakers; nails, screws, bolts and small tools; small toys; jars, tubes and cans of insecticides; gloves, secateurs and other gardening equipment; pottery, driftwood pieces used in floral arrangements; art equipment such as paints, brushes, and jars of the hobbyist; ink, glue bottles, adhesive tape, pens, nibs, thumb tacks, balls of string and other household odds and ends.

TRY THIS ONE...

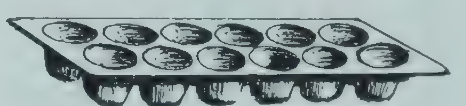
FELT-TIPPED MARKING PENS can be used to cover scuff marks on handbags and shoes. You can buy pens in all colours.

☆ ☆ ☆

MAKE LOOPS ON THE SHOULDERS of your toddler's shirts to hold the straps of his pants in position. Use heavy thread and work loops in the same way as you make belt carriers.

☆ ☆ ☆

STORE LEMONS in the bottom of an egg carton to prevent them rolling around the refrigerator or cupboard. Tomatoes and other small fruits can be stored in the same way.



☆ ☆ ☆

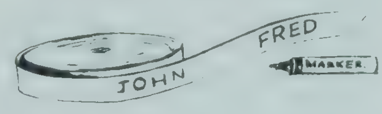
SMALL SEEDS are easy to handle if you pick them up with a wet matchstick. Seeds cling and can be planted exactly where you want them by twirling the match against the soil to release seed.

☆ ☆ ☆

SHOE POLISH ON YOUR HANDS? Slip your hands into small plastic bags before commencing work and you'll have shining shoes, spotless hands . . .

☆ ☆ ☆

NAME LABELS for marking school clothes and linen can be made by using a marker pen on iron-on tape. Test the staying power of the tape by marking a sheet before your next washday.



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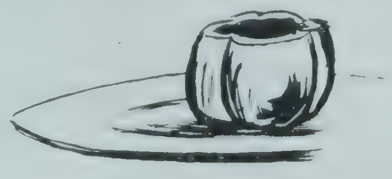
SALAD BOWL CENTREPIECE. Cut a slice from the stem end of a large red or green pepper and clean out the inside. Fill with salad dressing and place in centre of salad bowl or platter.



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WHEN MAKING SCONES or bread rolls, ring the changes by using fancy shaped biscuit cutters. Children love the variety.

☆ ☆ ☆

COUNTRY COOKING

MRS. Val Kingham, of Murrami via Leeton, enjoys cooking for dinner parties, and specialises in unusual dishes. To her credit in other fields of cooking is her championship award in section three of the *Land* 1964 cookery contest, won with her sponge sandwich.

The three children in the family, two girls and a boy, keep Mrs. Kingham busy. The whole family enjoys her special dish—

Cherry Macaroon Delite

2 cups coconut macaroons, crushed,
2 egg whites,
pinch of salt,
3 tablespoons castor sugar,
½ teaspoon vanilla,
¼ pint cream, whipped,
2 tablespoons glace cherries (soak in brandy if liked),
almond essence,
½ lb. cream wafer biscuits.

Chop cherries. Beat egg whites stiffly, add sugar and beat to meringue consistency. Fold in vanilla, almond essence to taste, whipped cream, chopped cherries and crushed macaroons.

Line sides of ice-cream tray or shallow cake tin with cream wafers and fill centre with macaroon mixture. Freeze until set.

Approximately six serves. •

TUBERCULOSIS-FREE HERDS

The following herds have been declared free of tuberculosis in accordance with the requirements of the scheme of certifying herds tubercle-free, and unless otherwise declared, this certification remains in force until the date shown in respect of each herd.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Australian Missionary College, Cooranbong (Jerseys)	123	Sept., 1965
Beddie, R. H., Old Grenfell Road, Forbes (Shorthorns)	124	Mar., 1965
Bonnington, R. A., "Leiroy", Shorthorn Stud, "Spring Camp" Curban (Beef Shorthorns)	77	Nov., 1965
Burke, J. & M. P., "Golden Valley", Forbes Road, Cowra (Beef Shorthorns)	62	Mar., 1965
Burnside Presbyterian Orphan Homes, North Parramatta (A.I.S.)	70	July, 1965
Cochrane, R. & C. C., "Parrabel Stud", Bega (Jerseys)	160	April, 1965
De La Salle College, Castle Hill (Ayrshires)	46	July, 1966
Eather, A. D. & J., "Milgarra", Bunnan (Beef Shorthorns)	65	Sept., 1965
Ewin, N., "Edenview", Greghamstown, via Blayney (A.I.S.)	60	May, 1965
Fairbairn, C. P. & C., Woomargamma Stn., Hume (Beef Shorthorns)	549	Nov., 1966
Farrer Memorial High School, Nemingha (A.I.S.)	93	May, 1964
Fleming, T. H. & Sons, "Russley", Aberdeen (Polled Shorthorns)	337	Aug., 1965
Franciscan Missionaries of Mary, Range Road, Mittagong (Friesians)	83	Mar., 1965
Freudenstein, F. J. & G. F., "Chippendale", Grenfell Road, Young (Beef Shorthorns)	89	June, 1966
Freudenstein, W. J. A. & Son, "Chippendale", Grenfell Road, Young (Beef Shorthorns)	133	June, 1966
Glen Mitchell Pastoral Co., Wellington (Poll Shorthorns)	170	April, 1966
Grafton Experiment Farm, Grafton (A.I.S., Angus)	436	Aug., 1965
Greaves, J. A., "Baroona", R.M.B. 63, West Wyalong (Beef Shorthorns) ..	44	Nov., 1965
Grey, T. J., Estate, "The Meadows", Albion Park (Jerseys)	147	Sept., 1966
Hawkesbury Agricultural College, Richmond	247	June, 1965
Hill, R. H. and Sons, Bulliac (A.I.S., Jerseys)	71	Oct., 1964
Hurlstone Agricultural High School, Glenfield (Ayrshires)	67	Aug., 1965
Limond Bros., Morisset (Ayrshires) ..	99	Aug., 1965
McSweeney, W. J., "The Rivers", Canowindra (Polled Shorthorns) ..	83	May, 1965
Maloney, D., "Heathvale", Broadwater (Jerseys)	46	Sept. 1966
Markham, J. & E., "Mara", Branxton (Jerseys)	57	Aug., 1965
Mullee Stud Farms Pty. Ltd., "Nairobi", Scone (Poll Herefords)	123	May, 1966
Mutton, J. T. & Sons., Bolwarra, Maitland (Jerseys)	100	Feb., 1965
O'Dea, C., "Sunnyside", Nepean Stud, Nth. Richmond (Friesians)	107	Mar., 1967
Peel River Land and Mineral Co., "Goonoo Goonoo", Tamworth (Polled Shorthorns)	412	Oct., 1966
Pratt, H. F., "Field View", Reserve Creek via Murwillumbah	127	Nov., 1966
Reid, D. B., "Evendale", Sutton Forest (Angus)	179	Dec., 1966
Reid, G. T., "Narrengullen", Yass (Angus)	540	June, 1965
St. Vincent's Boys' Home, Westmead (A.I.S.)	16	June, 1965
Scobie, C. & Son, Abingdon Jersey Stud, Lorn, Maitland	186	Sept., 1965
Simpson, F. S., "Gunnawarra", Gulargambone (Beef Shorthorns)	238	Aug., 1965
Simson, J. N., "Nowley", Spring Ridge (Shorthorns)	227	Feb., 1966
The Scots School, Bathurst (Friesians) ..	31	Nov., 1965
Registered Stud Herds—*continued*		
Training Farm for Boys, Berry (A.I.S.) ..	122	Jan., 1966
Trangie Agricultural Research Station, Trangie (Angus)	175	May, 1966
Vitnell, A., Dalwood (A.I.S.)	120	Feb., 1967
Wagga Wagga Agricultural College (Jerseys, Poll Shorthorn)	167	May 1965
Walsh, Mrs. H. R., "Water View", Cowra (Beef Shorthorns)	127	Mar., 1967
Waters, G., "Willow Dell" Jersey Stud, "Boongala", Deniliquin	139	Mar., 1965
White, H. F., Bald Blair, Guyra (A.A.) ..	147	June, 1965
Willis, R. N. & D. M., Westbrook, Mt. Hunter, via Camden (Ayrshire) ..	207	Nov., 1966
Wollongbar Agricultural Research Station, Wollongbar (Guernseys, A.A.) ..	140	June, 1965
Wombramurra Pty. Ltd., "Wombramurra", Nundle (Devon)	136	April, 1966
Wright, Miss I. M., "Awatea Jersey Stud", Paddy's Plains, North Dorrigo	54	Dec., 1966
Yanco Agricultural High School, Yanco (Jerseys)	127	Oct., 1965
Yanco Agricultural Research Station (Jerseys, Guernseys)	115	Dec., 1965
Herds Other than Registered Stud Herds		
Adams, B. & L., "Garryowen", Wallamore Rd., Tamworth	59	Nov., 1965
Adastra Dairies Pty. Ltd., Terrace Rd., North Richmond	106	July, 1966
Baker, R. W., Luskintyre, Lochinvar ..	74	Oct., 1966
Barnardo's Homes, Dr., Tooloogan Vale, Scone	146	Feb., 1967
Bennett, J. F. M., "Oaklands", Pambula	90	May, 1965
Bethsam Holiness Mission, Wyee ..	17	Feb., 1967
Bladwell, W. R., "Loloma", Goulburn	128	Dec., 1965
Bowen, A. H., Stroud	73	April, 1966
Bridge & Bowden, Mill Creek, Stroud Road	47	April, 1965
Brookfield Afforestation Camp, Mannus	291	May, 1966
Brown, R., Valery	58	Aug., 1965
Charlton, R. J., Caniba Street, Lismore	66	Dec., 1965
Chesham, C. H., Picton Road, The Oaks	45	April, 1965
Child Welfare Dept., "Werrington Park", St. Marys (A.I.S.)	37	Feb., 1966
Coilsfield Pty. Ltd., "Coilsfield", Orange	244	Dec., 1965
Cole, E. J. & Sons, Lochiel	127	April, 1966
Cole, G., South Pambula	53	Oct., 1965
C. V. and H. G. Denton, "Yarrawood Farm", Merimbula	91	May, 1965
Croagh Patrick Orphanage, Park St. Orange	61	Feb., 1966
Dunsire, Mrs. T., "Glenara", Riverview Rd., Lansvale	164	May, 1966
Ellensville Est., "Ellensville", Glenmore, via Camden	154	Dec., 1966
Ellwood, H., Attwater Avenue, Cessnock	61	Mar., 1966
Enright, M. (Mrs.), "Hinton Vale", Hinton	95	June, 1966
Fairbridge Farm School, Molong ..	73	Jan., 1966
Farley, D. J., Stroud	88	Dec., 1965
Foley, L. F., Lucknow, via Orange ..	29	Dec., 1965
Forster & Sons, "Abington", Bundarra	53	April, 1966
Franciscan Fathers, Maryfields, Campbelltown	50	April 1965
Gilbert, A. E., Mill Creek, Stroud .	117	Aug., 1966
Gorton, I. E., Stroud Road, N.S.W. ..	76	Dec., 1966
Greenham, J. R., Hill Creek, Stroud ..	45	Sept., 1965
Harrington, J. B. & J., "Mt. Erin" Campbelltown	97	Nov., 1965
Harrington, P. P. "Glen Erin", Leumeah	69	Nov., 1965
Hawkey, H. R., "Trevone", Menangle	271	Nov., 1964

Tuberculosis-free Herds—continued

Owner and Address	Number Tested	Expiry Date
Herds other than Registered Stud Herds—*continued*		
Hawkins, G. A., Freemans Reach	63	Mar. 1965
Her Majesty's Training Centre, Emu Plains	151	Feb. 1966
Her Majesty's Training Centre, Goulburn	29	Mar., 1966
Hill, W. S., "Questwill", Crooked Lane, North Richmond	55	July, 1966
Hill, R. H. & Sons, Bulliac	107	Oct., 1966
Johnson, J. R. & P. M. Wallamore Road, Tamworth	123	July, 1965
Kenmore Hospital, Kenmore	120	Mar., 1965
Lee, G. N., Taree	62	Nov., 1966
MacArthur Stanham Holdings Pty. Ltd. Camden Park, Menangle	279	Mar., 1966
McGrogan, J., Percy Street, Singleton	83	Jan., 1967
Margery, G. W., Stroud Road, Stroud	68	Aug., 1965
Merchant, Mrs. P., East Gresford	85	Dec., 1965
Moffit, C. E., Central Tilba	161	Dec., 1965
Monkittee Pastoral Co., Braidwood	47	Nov., 1965
Morisset Hospital, Morisset	89	Mar., 1967
Moxham Bros., "Mullengudgery", Mullengudgery	112	Dec., 1966
Mt. Penang Training School (Gosford Farm Homes), Gosford	68	May, 1965
Naroo Pastoral Co. Pty. Ltd., "Jemalong", Forbes	403	Jan., 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong	101	Sept., 1965
O'Dea, C., "Sunnyside", North Richmond	94	Mar., 1963
Odewahn, R., 113 Argyle St., Parramatta	20	Sept., 1965
North Parramatta Psychiatric Centre	48	Aug., 1965
Passionist Fathers, Mary's Mount, Goulburn	22	Mar., 1966
Perry, K. T., Millingandi, via Eden	69	July, 1965
Pitt, S. R., Wylie's Flat, via Singleton	44	July, 1966
Ramsey, E. J., "Manor Park", Parkes	100	Feb., 1965
Ryan, P., Hallsville	33	July, 1965
Rydalmere Hospital, Rydalmere	28	Nov., 1965
cott, S., Mullumbimby	71	Sept., 1966
Herds Other than Registered Stud Herds—*continued*		
Shelldrake Bros., "Clearview", Box 11, Picton	93	Nov., 1966
Simpson, A. T., "Kenso", Forest Road, Orange	191	April, 1966
Stinson, J. B., Church Lane, Castlereagh	88	Oct., 1966
St. John of God Training Centre, Morisset	22	Sept., 1965
St. John's Orphanage, Goulburn	9	Mar., 1965
St. Joseph's Orphanage, Cowper	77	Nov., 1966
St. Joseph's Orphanage, "Kenmore", Goulburn	5	Mar., 1965
St. Joseph's Orphanage, Kincumber	39	April, 1966
Sternbeck, C. H., Laguna House, Laguna	109	April 1965
Sydney Church of England Grammar School, Moss Vale (Jerseys)	210	Nov., 1966
Taylor Bros., Tathra Road, Bega	145	Nov., 1965
Tegel, A. A. Pty. Ltd., Heath Road, Leppington	92	Nov., 1966
Thompson, L. K., "Redbourneberry", Singleton	57	Mar., 1967
Turner, R. G., "Merriwinga", Tilba Tilba	67	Sept., 1964
Training School for Boys, Mittagong	91	Feb., 1956
United Protestant Association, "Sunny Lands", Wollongbar	39	Nov., 1966
Whelan, W. G., Kiah, via Eden	62	Nov., 1966
Whelan, W. R., Bulahdelah	56	April, 1966
Wiley, F. J., Candelo	12	June, 1965
William Thompson Masonic School, Baulkham Hills	66	Sept., 1965
Williamson, R. J., Fattorini Island, Gladestone, N.S.W.	55	April, 1966
Wilson, A. J., Nicholls Street, Stroud	57	Nov., 1965
Wilson, K., Woodlawn, via Lismore	51	Sept., 1966
Wood, Mrs. J., Redbourneberry, Singleton	16	Sept., 1966
Youth Welfare Association of Australia, Hopewood, Bowral	241	Dec., 1966

R. A. HALL, Chief, Division of Animal Industry.

Brucellosis-free Herds (Cattle)

The following herds have been declared free of brucellosis in accordance with the requirements of the scheme of certifying herds brucellosis-free.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Burke, J. and M. P., "Golden Valley", Cowra (Beef Shorthorn)	58	April, 1965
De La Salle College, Oakhill, Castle Hill (Ayrshire)	46	July, 1965
Hurlstone Agricultural High School, Glenfield (Ayrshire)	67	Aug., 1965
McSweeney, W. J., "The Rivers", Canowindra (Poll Shorthorns)	83	May, 1965
"Wombramurra", Pty. Ltd., Nundle (Devon)	135	May 1965
Herds Other than Registered Stud Herds		
Fairbridge Farm School, Molong	73	Feb., 1966
Mt. Penang Training School, Gosford	62	June, 1965
St. John of God Training Centre, Morisset	22	Feb., 1966
Training School for Boys, Mittagong	91	Feb., 1966

R. A. HALL, Chief, Division of Animal Industry.

Brucellosis-free Herds (Swine)

The following is a list of names and addresses of owners of herds which have been declared brucellosis-free in accordance with the requirements of the Brucellosis-free Herd Scheme (Swine).

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Boyle, W. R., Alford Point Road, Menai (Tamworth and Berkshire)	15	June, 1965
Campbell, D. C., "Hillangrove Stud", Wamberal (Large White)	18	Feb., 1966
Carter, P. L., Woorak Stud, Pine Ridge, via Quirindi (Tamworth & Large White)	37	July, 1965
Draper, R. E., "Glengar", Capertee (Tamworth)	6	Nov., 1965
Farrer Memorial Agricultural High School, Nemingha (Berkshire)	9	April, 1965
Grafton Experiment Farm, Grafton (Berkshire)	15	April, 1965
Hawkesbury Agricultural College, Richmond	55	Mar., 1965
Hurlstone Agricultural High School, Glenfield (Berkshire)	7	Sept., 1965
Registered Stud Herds—*continued*		
Lambeth, A. J., "Talanga", Douglas Park (Berkshire)	11	May, 1965
Maxwell, J. D. "Brooklyn", Barmedman	10	July, 1965
Mt. Penang Training School, Gosford (Berkshire)	10	June, 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong (Berkshire)	7	Aug., 1965
Wagga Agricultural College (Berkshire, Tamworth and Large White)	22	Sept., 1965
Wollongbar Agricultural Research Station, Wollongbar (Tamworth)	29	July, 1965
Yanco Agricultural High School, Yanco (Berkshire)	19	Sept., 1965
Herds Other than Registered Stud Herds		
Brookfield Afforestation Camp, Mannus	15	April, 1966

R. A. HALL, Chief, Division of Animal Industry.

Areas Undergoing Regular Testing for Tuberculosis

Quarantine Areas (Tuberculosis)—Urban Areas

The following areas have been declared quarantine areas to ensure that a tubercle-free milk supply is available to residents. No cattle from which milk or milk products are obtained for human consumption are allowed to be kept therein unless subjected to the tuberculin test and found free from tuberculosis:

Barraba
Bingara
Braidwood
Casino
Condobolin
Cooma
Coonabarabran
Coonamble
Crookwell
Cudgegong
Glen Innes
Goobang
Grenfell
Griffith
Inverell
Junee
Kempsey
Manilla
Moree
Muswellbrook
Nyngan
Parkes
Queanbeyan
Tullamore
Walgett

Quarantine Areas (Tuberculosis)—Eradication Areas

The following areas have been declared quarantine areas for the purpose of eradicating tuberculosis from cattle contained therein. All owners are required to have all their cattle tested for tuberculosis when notice for testing is served:

Allyn
Bega
Bellingen
Bodalla
Brushy Hill
Burringbar
Busby's
Caniaba
Cessnock
Chichester
Clybucca
Comboyne
Coraki
Cumberland
Denman
Dilkoon
Dorrigo
Dungog
Dyraaba
East Casino
East Kempsey
Eden Creek
Fawcetts
Gloucester
Grafton
Illawarra
Kameruka
Kyogle
Lavadia
Lawrence
Lostock
Lower Hunter
Maclean
Maitland
Manning
Marshdale
Martindale
Milton
Moss Vale
Mullumbimby
Myrtle
Nabiac
Nambucca
Narooma
Nimbin
Nth. Hastings
Nth. Tweed
Orara River
Picton
Salisbury
Scone
Singleton
Southgate
South Lismore
Stewart's River
Tintenbar
Tyalgum
Ulmarra
Upper Richmond
Upper Wollomba
Warkworth
West Kempsey
Wingham
Wollombi Brook
Woodburn
Woodford Island

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BETTER LIGHTING FOR FARMS

AS THE RESULT of the progress of rural electrification in Australia, the farmer of today has at his disposal many modern conveniences—by no means the least important being adequate lighting.

Gone are the days of the hurricane lantern, the pressure lamp and, in most cases, inadequate low voltage lighting plant. Ample electric light is now available at the flick of a switch.

Lighting may be required for everyday tasks or only in an emergency. Whichever is the case, good light will make the task easier.

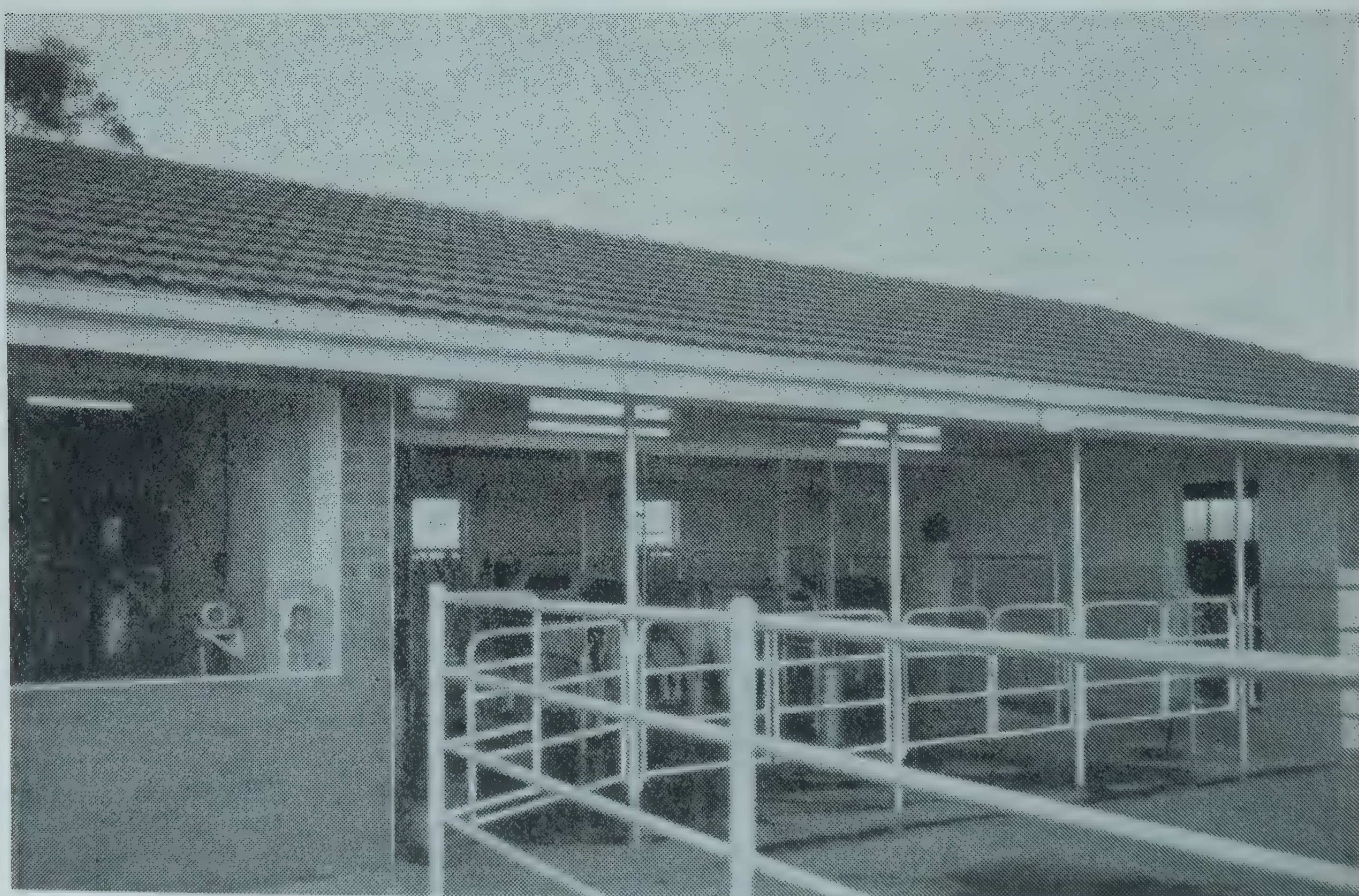


Fig. 1. Modern lighting should be part of every modern dairy

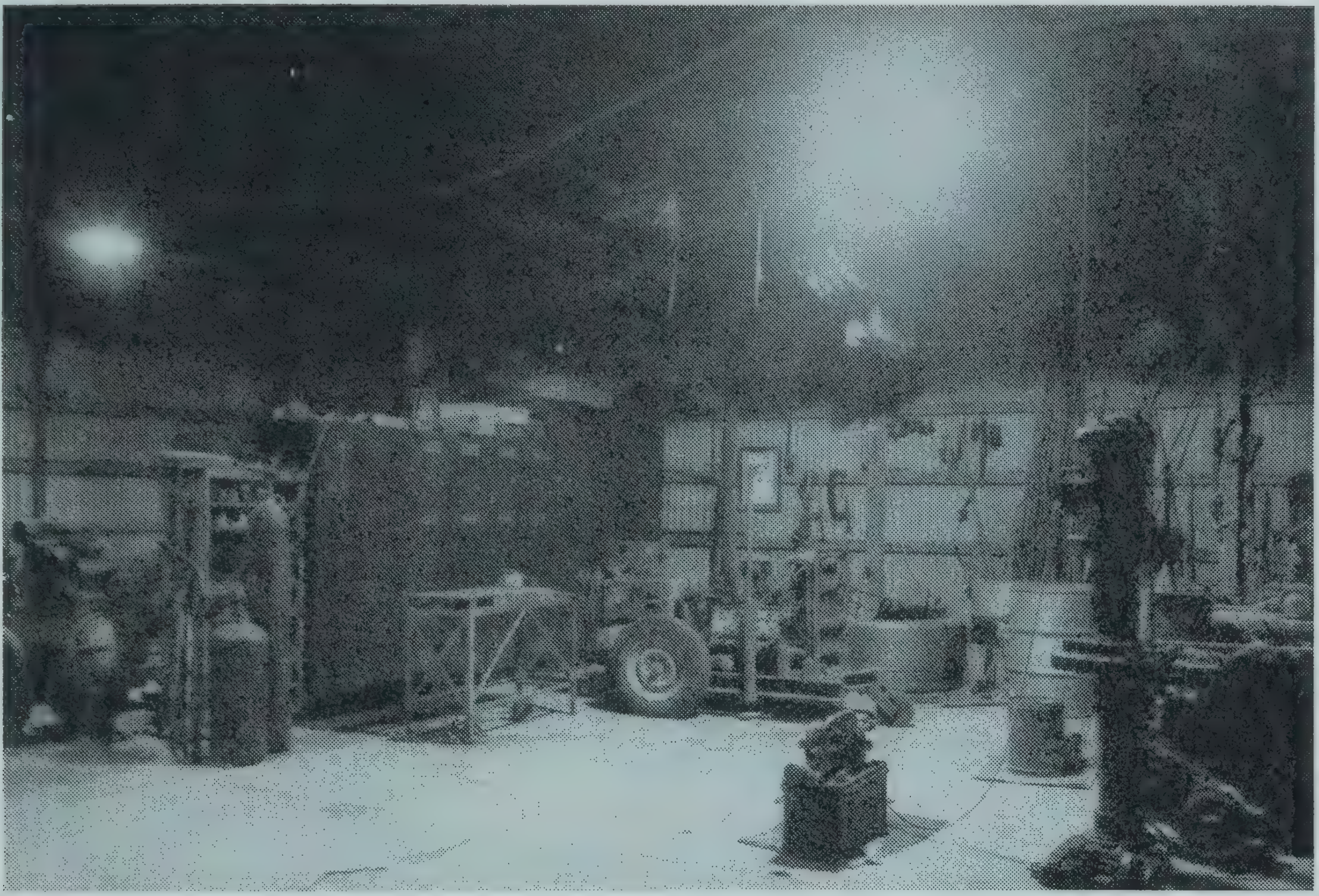


Fig. 2. Repair jobs for a rainy day demand proper lighting

Fig. 3. Plenty of light where it's needed makes for better work

The dairy

Take, for instance, the dairy farmer, who must milk his cows at regular hours both in summer and winter. In most cases, adequate lighting is available during the summer, but in the winter months it is necessary to provide additional lighting.

Figure 1 shows a modern dairy with 40-watt fluorescent units on the ceiling and slightly behind the cows, providing good lighting for milking. A bulkhead unit on the fascia lights the cow yard.

The workshop

During sowing and harvesting, the farmer must often work around the clock and, should a breakdown occur, repairs must be made quickly. In some cases the implement or tractor has to be brought back to the workshop. Good lighting will play an important part in the race against time.

Figure 2 shows a typical farm workshop with the main lighting being provided by a 300-watt mercury/tungsten lamp in a dispersive reflector.

Figure 3 shows a slightly more elaborate workshop, lit with 40-watt fluorescent units on the trusses plus a 300-watt mercury/tungsten lamp in a dispersive reflector. A daytime view of the same workshop, figure 4, shows how translucent plastic roof panels have been used to improve day-lighting conditions. The pit seen in Figure 5 is fitted with four bulkhead units and greatly facilitates underside maintenance and repairs to vehicles.

Shearing shed and sheepyard

Sometimes lighting is required only for a short time each year, as in the case of shearing. In such a job, good lighting can mean easier working for the shearer and less discomfort for the sheep. It must be pointed out that union rules prohibit shearers from working at night, therefore artificial lighting is used only on dull days as a supplement to daylight.

At times it is necessary to yard sheep at night in preparation for either shearing or trucking. Figures 6 and 7 show day and night views of a yard and loading ramp adjacent to the shearing shed. A 1,500-watt fibreglass "arena" floodlight provides adequate illumination.

Additional area lighting apparent in figure 7 is provided by a similar floodlight on the end of the shed.

General area lighting

Apart from all the specific applications for lighting on the farm, general area lighting is always a useful adjunct.

Fig. 4. Translucent roof panels improve lighting, and help save electricity.

Fig. 5. Underside maintenance of vehicles is much easier with adequate pit lighting.

Fig. 6. Provision of lighting in the shearing shed area is often neglected

Fig. 7. Good, general illumination of yards adjoining the shearing shed

The potato farm

Not all farms run cows or sheep, or grow cereal crops. In the Mount Lofty Ranges in South Australia are some of the largest potato-growing properties in Australia. Some of these properties have installed up-to-date lighting and transparent plastic roof panels over washing and grading machines.

The poultry farm

Another application of lighting is in the poultry industry. Artificial lighting is used effectively to influence the laying cycle and to increase production during autumn and winter. Also, by using patterns of decreasing light, farmers are influencing the rate of maturity in young pullets. ●

Adapted from an article in *I.E.S. Lighting Review*, Vol., 25, No. 3, 1 June, 1963.

Breeding Wheats Resistant to Loose Smut

At this stage loose smut spores are able to infect adjacent susceptible plants.

A. T. Pugsley

LOOSE SMUT, like bunt, is caused by one of the parasitic smut fungi.

The loose smut fungus infects the wheat plant at flowering time and establishes itself within the grain, out of reach of any fungicidal dust that may be applied before seeding. Infected seed may be treated by immersion in hot water but because of the critical temperatures required this method cannot readily be used on the farm.

During the past ten years it has been possible to transfer inherent resistance to standard varieties, such as Heron, by use of the back-cross technique. Six to eight hours after the cross is made a droplet of water containing the fungus spores is placed inside the wheat flower. In the subsequent generation, susceptible hybrids develop loose smut but the sister lines carrying inherent resistance remain healthy. It is from the latter that new, resistant strains are developed.

The task of adding resistance to the popular Heron variety has now been completed. The new strain is being multiplied and checked before being released to wheat-growers.

The Author: Dr. A. T. Pugsley, Director, Agricultural Research Institute, Wagga Wagga.

SOME NORTH-WESTERN METHODS OF

Temporary Grain Storage

R. F. KOMOLL

A COMMON PROBLEM among New South Wales wheatgrowers last season was to find suitable temporary storage for grain on their properties. Long delays at receival points forced many farmers to look for temporary grain storage methods that were both simple and efficient.

The diversity of these methods was great, and was limited only by individual needs and ingenuity. Faults were quickly apparent, and modifications were made where necessary.

Briefly described are some of the more popular methods used, as continued good seasons might put farmers in this situation again in the near future.

Whichever method is used, for safe and efficient storage the following are essential requirements:

- Select a well-drained site;
- Locate bins centrally;
- Fasten weldmesh securely;
- Place bins in sheds where possible;
- Treat grain against weevil attack;
- Unload bins evenly;
- Control the moisture content;
- Do not overfill mesh bins;
- Do not use plastic under the wheat; and
- Avoid walking on the grain.

The Author: Mr. R. F. Komoll, District Agronomist, Gunnedah.

Photographs by Mr. J. A. Cameron, Publicity Officer, North Western Region.

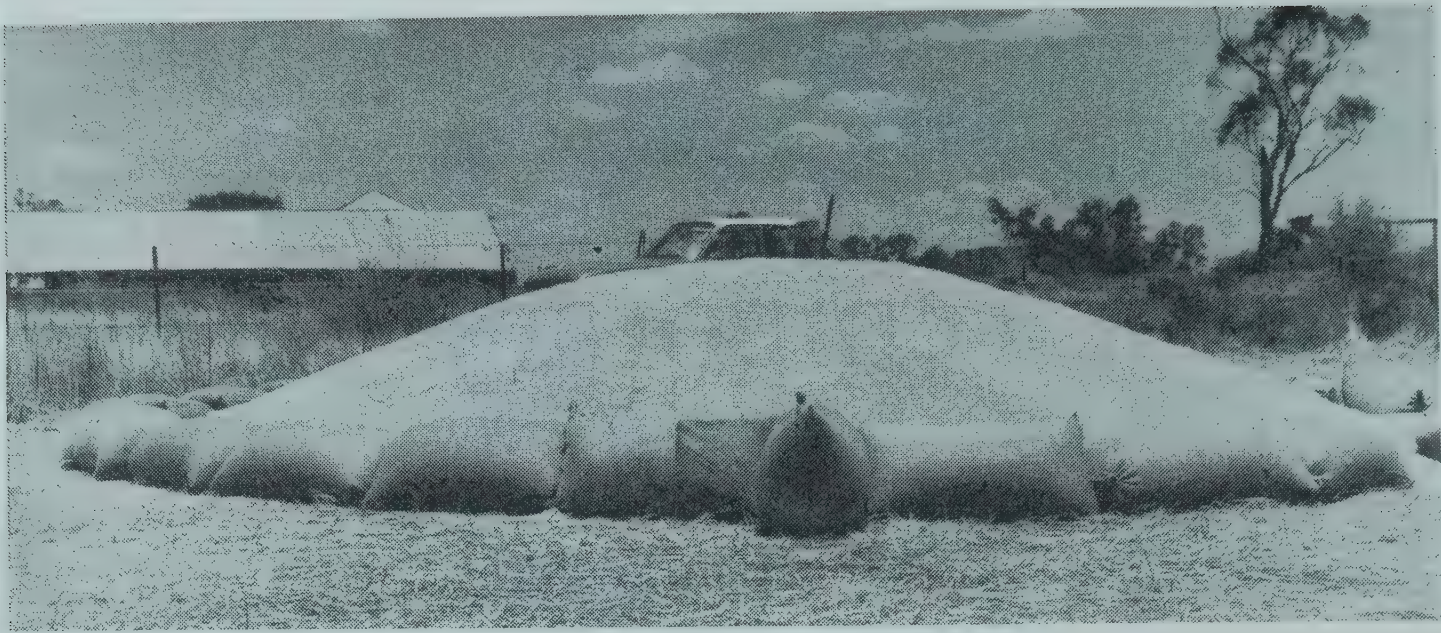


Fig. 1

Fig. 1. Wheat is emptied direct from header box on to ground; ring of bagged wheat prevents spread. No cover or ground seal is used—grain sheds water well and soil draws out any basal moisture. Choose a well-drained site, centrally located. Dump shown was smallest in district—some reached 17,000 bags; on most sites stubble was levelled with a rotary mower and compacted with a motor vehicle.

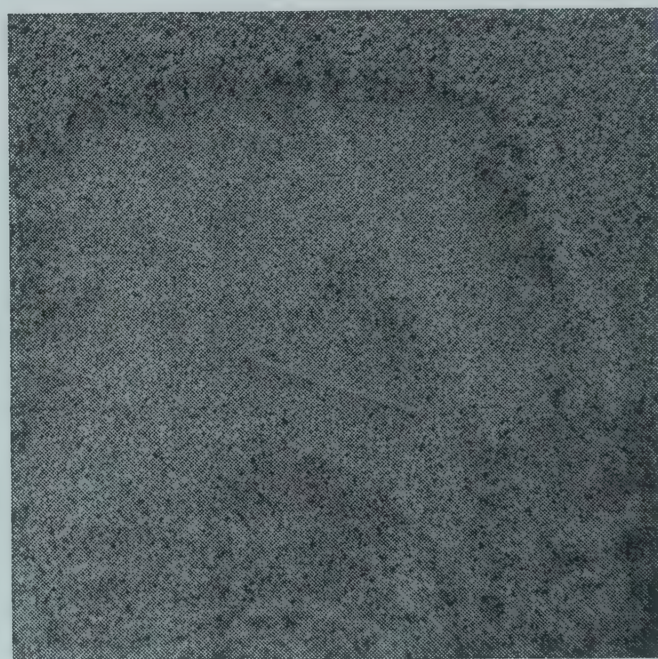


Fig. 2

Fig. 2. Surface of a dump after five inches of rain; dump contained 30 tons of wheat and only 30 bushels was damaged. The surface of the dump seals after wetting and sheds water well; only top half-inch is damaged by becoming shot and sprung. Picture shows undamaged grain under opening in sealed surface (wheat in paddock awaiting harvest when picture was taken dropped in bushel weight from 63 lb. to 54 lb. as a result of the same rain). There is less damage and greater saving with this method than by bagging.

Fig. 3

Fig. 3. Loading the last of dump shown in Fig. 2, Mr. Pat Kelly of Gunnedah (left), uses a sweep auger; small amount of grain not delivered as F.A.Q. was used as pig feed. This dump was in the centre of four twenty-five acre blocks; as the header stripped each block, it moved to dump and discharged from the bagging doors, delivering 30 bushels in 35 seconds. Delivery auger was later fitted to header to facilitate unloading either into dump or direct into bulk trucks.

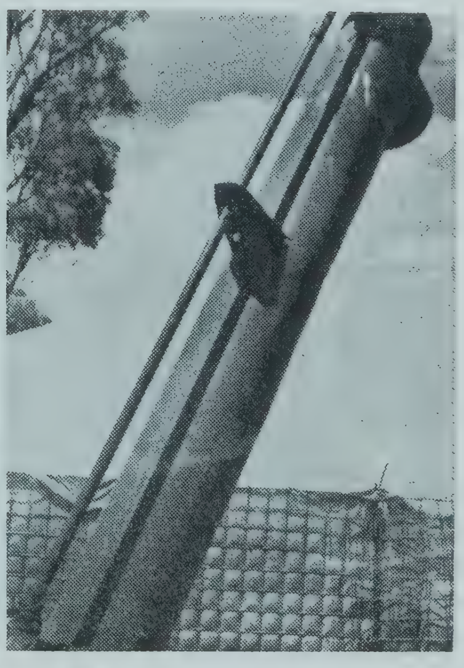


Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 4. Three temporary mesh silos at "Mooki Springs", Pine Ridge—each contains 1,000 bushels, costs £16 (this covers mesh, hessian and fastening clips). One length of mesh holds 1,000 bushels, one and a half lengths 2,000 bushels, and two lengths 4,000 bushels. Overfull bins of this type are vulnerable to bird damage, and the "angle of repose" varies with weight and condition of grain.

Fig. 5. Join in the mesh and the hessian lining—hessian SHOULD be turned over top of the mesh. A strong join should be made in the mesh, as pressure build-up is severe—steel rod laced through the ends of the mesh makes a good join. The auger shown has delivered from a trailed field bin servicing several headers.

Fig. 6. Two silos on high ground in the Blackville area—silos have been covered with polythene; auger opening is provided. The mobile bin has been drawing wheat from the black-soil plain.

Fig. 7. Close-up of auger opening in bin in fig. 6. A four-gallon drum with top and bottom removed, inserted at an angle, provides ideal access for the auger. Drum has been wired to mesh at the upper rim, and the wheat will not flow through. A bag flap protects the opening and, when inserted, the auger end reaches the centre floor of the bin. This method reduces the risks of uneven loading (bin collapse).

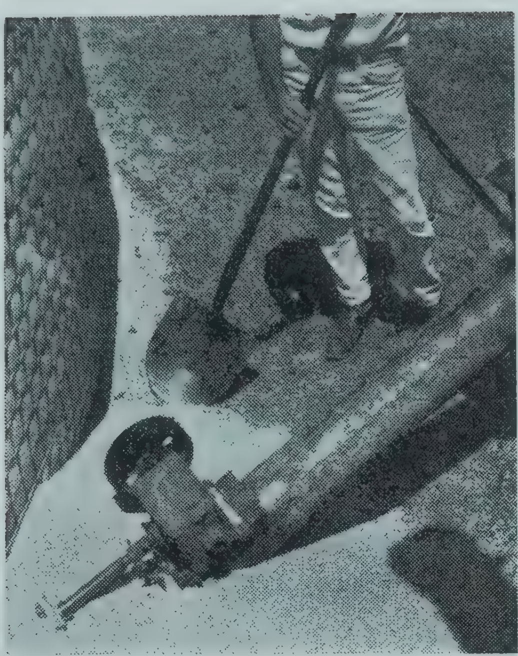


Fig. 8

Fig. 9

Fig. 8. This has been the most widely adopted emptying method. A hole dug at the base of the bin allows entry for the auger. If care is not taken bin collapse is possible; empty from more than one point.

Fig. 9. This bin was built on a well-drained site but spilt its 4,000 bushels because of inadequate fastening and excessive slope of land. Apart from inconvenience, the only loss was labour costs. Uneven emptying also will cause wall collapse.

Fig. 10

Fig. 11

Fig. 10. A "stalagmite" of wheat—walking on top of the full bin has caused compression of the grain, thus leading to the conduction of moisture. These areas can penetrate right through the stack with subsequent damage to the grain. Once a bin is full, take care not to disturb the grain.

Fig. 11. Over 30,000 bushels of permanent storage space at "Pine Cliff", Curlewis. This ideal storage gives ready access to discharging and loading vehicles. Cost of this storage was quickly recouped from premium payments, grain saved from damage during bad weather, and delivery delays.

Fig. 12

Fig. 12. Perhaps the ultimate in farm storage, these silos at "Pine Cliff" are arranged to allow for rotation of contents from one to another. The central elevator lifts grain from a concrete sump below each of the four silos; grain can be directed to another silo in the group or into a smaller hopper which gravity-fills waiting semi-trailers in a few minutes. Grain is dumped from trucks through a floor-grid which feeds the central sump; the grain is treated with a malathion spray as it is elevated to the silo.

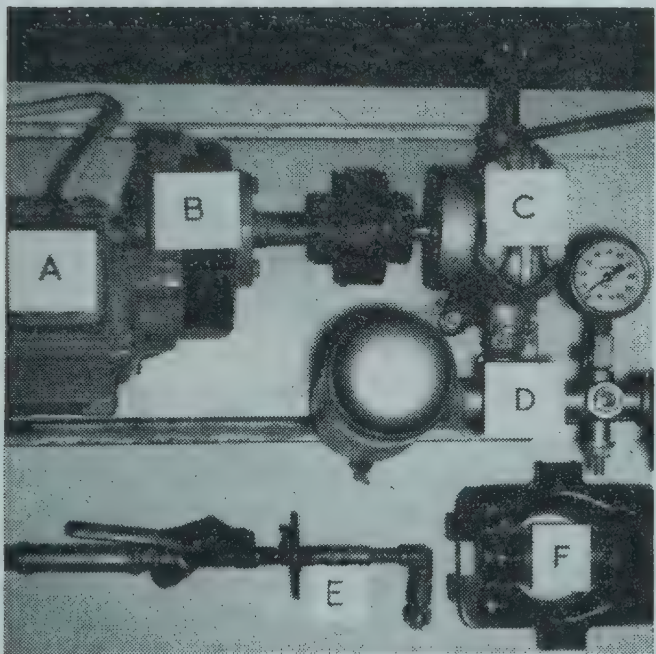


Fig. 13

Fig. 13. With long delays before delivery, grain is most vulnerable to weevil attack. Unit shown at left is a twin-piston pump jetting plant, readily adaptable to spray malathion solution directly into the auger casing during final loading of the grain. This unit fulfils many other useful duties on the property. Letters indicate: A—electric motor (a petrol version is available); B—reduction gear; C—twin-piston pump; D—pressure equalising cylinder and pressure gauge; E—nozzle and flange; F—cutaway of pump unit.

Fig. 14

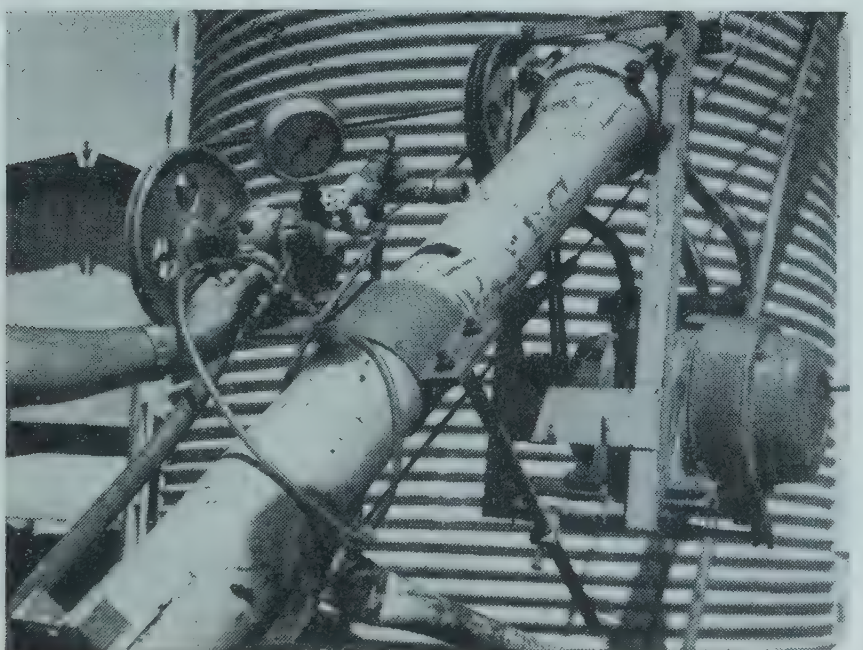


Fig. 14. Auger fitted with an insect protectant-spraying apparatus. This one uses the auger motor drive and is easily detached for fitting to other machines. The spray nozzle (held in hand) is tapped into a flange in the casing. Tables are available showing operating pressures, governed by flow rate of wheat and nozzle aperture. The unit is supplied through rubber hoses from a bulk reservoir. This treatment gives season-to-season protection, and can be done for a cost of only ninepence per ton. ●

Mr. Enticknap

Minister Retires

MR. A. G. ENTICKNAP retired as Minister for Agriculture on 30 April this year. He had held this appointment since March 1962.

Early in his career Mr. Enticknap took up an irrigation farm at Leeton, New South Wales. Until his entry into Parliament he conducted this farm himself, producing fruit and prime lambs.

From 1925 to 1938 he was a member of the Willimbong Shire Council (now Leeton Shire), and in 1938 he was President. Also during most of this period he was Chairman of the Leeton Fruitgrowers' Co-operative Society.

From 1930 to 1935 he was Chairman of the Australian Canning Fruitgrowers' Association, a member of the New South Wales Citrus Growers' Association, an Executive of the New South Wales Apple and Pear Growers' Association and a member of the Murrumbidgee Irrigation Area Co-operative Executive.

Mr. Enticknap was Manager of the Yenda Producers' Co-operative Society Limited from 1938 to 1941, and from the foundation of the Leeton Co-operative Cannery Limited in 1935, until February 1955, he was its Chairman of Directors.

Mr. Enticknap entered the New South Wales Parliament as an Independent Labor Member on 10 May 1941, as Member for Murrumbidgee. He was re-admitted to the Labor Party in June 1942, and was re-elected Member for Murrumbidgee at each subsequent election.

Mr. Enticknap was elected to the Ministry in April 1952, and was Minister Without Portfolio until November 1952, when he became Minister for Conservation, having acted in that portfolio during the illness of the previous occupant.

After the election of 1956, Mr. Enticknap became Minister for Transport, and held that portfolio until 1960, when he was again appointed Minister for Conservation.

In 1959 Mr. Enticknap visited North America, the United Kingdom and the Continent to study transport administration problems.

Investigations were conducted in the U.S.A., Canada, the United Kingdom and on the Continent, and Mr. Enticknap submitted a report to the New South Wales Parliament on his return.

In 1962 he was appointed Minister for Agriculture and Minister for Conservation.

Mr. Enticknap has a proud record of over 40 years in public life, including nearly 24 years as a Parliamentarian. •

Advances in Control of Barley Grass

E. G. Cuthbertson

UNTIL RECENTLY field control of barley grass was limited to cultural methods based on the premise, that most, if not all, seed produced in spring germinates the following autumn and early winter.

Control is achieved either by reverting to cropping, when autumn cultivations destroy many seedling plants—thus reducing the number of plants producing seed—or by removing pasture growth in the spring.

Either method also reduces the amount of seed produced. Correct timing, however, is essential, because control depends on cutting the area for hay or silage after the ear has started to move up the stem but before it has emerged from the flag leaf. Because of the general structure of grass, removal of the ear kills that particular tiller. Plants so treated must develop completely new tillers before they can set seed.

Cultural control methods are rarely completely effective. They seem to keep a

The Author: Mr. E. G. Cuthbertson, Senior Research Officer, Agricultural Research Institute, Wagga Wagga.

2,2-DPA (right) applied in July at 2 lb. per acre removes most grasses and much of the clover. Lucerne is only slightly damaged.

Paraquat® (right) applied in July at from 2 to 4 oz. per acre removes barley grass leaving a mixed grass clover pasture. Lucerne is not damaged.

weed in check but never to eradicate it. Consequently, barley grass quickly reverts to dominance when the cropped land is returned to pasture or the spring mowing is abandoned.

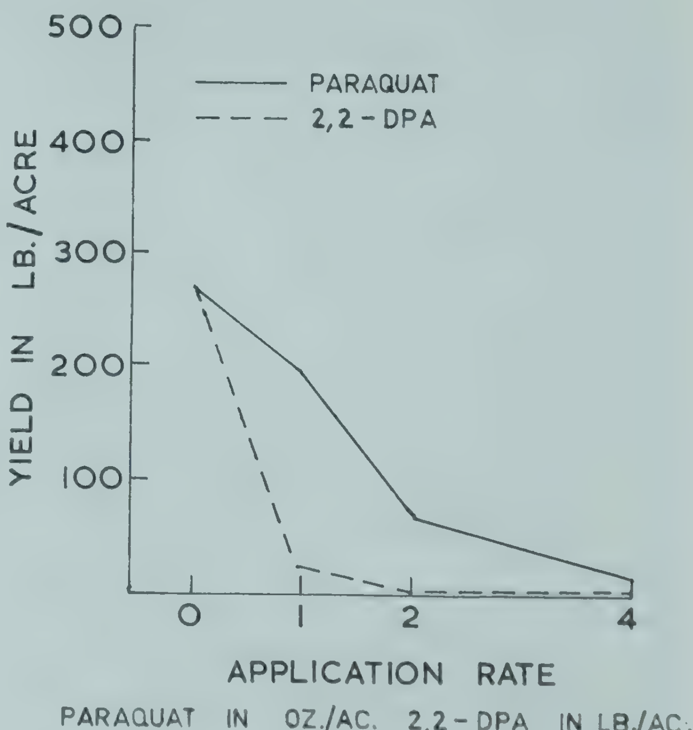
Chemical control

During the last decade the development of selective chemical herbicides has revolutionised the control of many weeds, including barley grass. Among the many compounds developed, some have been more injurious to grasses than to the broad-leaved weeds. Unfortunately, most of them have been very expensive and usually damaged the crop or pasture.

Nevertheless, TCA and 2,2-DPA were found useful for barley grass control in some crops, especially lucerne, and occasionally on small areas of heavily infested pasture.

TCA

The action of TCA is mainly through the roots. As a result, better control of barley grass is obtained by applying it to a fallow rather than to the growing plant. Complete control of barley grass has been obtained with 4 to 8 lb. per acre applied to the fallow, when the same amount applied to a seedling infestation gave little more than 50 per cent control.



Yield of barley grass following application of Paraquat and 2,2-DPA in July.

As might be expected, TCA is most effective when the soil is moist. In fact, light rain or a light irrigation after application is often beneficial. On the other hand, too heavy a fall of rain or over-watering can reduce its effectiveness by dilution and by leaching beyond the root zone.

TCA is not usually recommended for barley grass control in Australia because of its residual effects, which may be observable for several months after application. On the other hand, it is used for winter application to perennial pastures in New Zealand as a means of barley grass control.

2,2-DPA

The sodium salt of 2,2-DPA is also useful in some situations. Heavy infestations of barley grass have been removed by spring applications of 2,2-DPA at 5 to 10 lb. per acre, while as little as 1 lb. per acre has given satisfactory results in some places.

These heavy application rates seriously damage other plants, however, and top growth is often removed completely.

Some pasture species show a reasonable tolerance to 2,2-DPA, but most clovers, particularly subterranean clover, are seriously affected, and their yields are drastically reduced in the year of application.

Lucerne seems quite tolerant of 2,2-DPA, and commercially acceptable control of barley grass is possible with application rates of 2 to 5 lb. per acre.

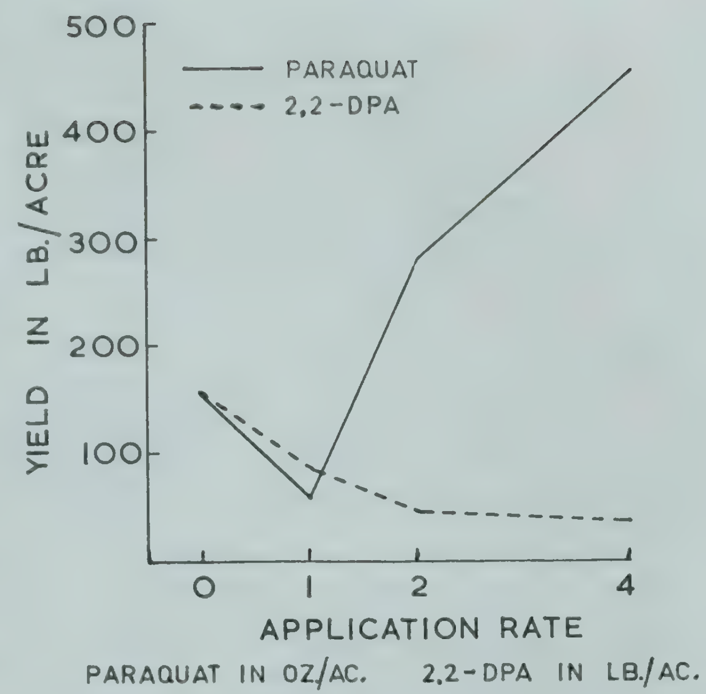
The bipyridyl herbicides

Recent development of the bipyridyl herbicides Diquat® and Paraquat® has made possible a new approach to many weed control problems.

These herbicides have rapid desiccating properties, show marked activity—particularly against annual species—at very low application rates, and are rapidly absorbed and translocated through the aerial parts of the plant.

The rapid absorption by the plant means that the chemicals are "rainfast" and although they are water soluble, rain shortly after application usually has little effect on their toxicity. Most important of all, however, is the complete absence of residual effect. Both herbicides are instantly absorbed and inactivated on contact with the soil.

® registered trade name.



Yield of subterranean clover as affected by Paraquat and 2,2-DPA applied in July.

Both Diquat and Paraquat are effective against a wide range of plants, although Paraquat is more active against grasses than is Diquat.

Translocations seem to be confined to the aerial parts of plants. As a result, while annual species are killed, desiccation of the top growth of perennials is usually followed by active re-growth from the crown.

These characters make Paraquat particularly useful against barley grass in pastures.

In experiments at the Wagga Agricultural Research Institute, best control of barley grass was obtained with a July application of Paraquat at 2 to 4 oz. active ingredient per acre after the pasture was grazed down. A commercially acceptable control was also obtained with a May application at slightly lower rates, namely 1 to 2 oz. active ingredient per acre.

Unfortunately, subterranean clover seedlings were damaged by the May application. The July applications only scorched the then well-established plants which, in the absence of competition from barley grass, gave greatly increased yields.

In comparative trials with 2,2-DPA on lucerne, and on clover-based pastures, while both herbicides gave effective control of barley grass, 2,2-DPA damaged other species far more than did Paraquat. 2,2-DPA reduced clover yields substantially throughout the season, and reduced lucerne yields at least for the first cut after application.

Information from other sources suggests that Phalaris, cocksfoot, perennial ryegrass and white clover also are more tolerant of Paraquat than of 2,2-DPA. Lucerne and subterranean clover are tolerant of normal rates of Paraquat once well established.

The main disadvantage so far determined with the bipyridyl herbicides is the amount of water required. In general, the very low application rates used requires that spray cover must be excellent if satisfactory results are to be obtained. All available data indicate that these herbicides lose effectiveness if applied at less than 20 gallons per acre.

The future

It may be predicted, with some certainty, that chemical control of weeds will become as commonplace in the future as cultivation is today. One can confidently expect, therefore, that chemical control of barley grass will also be commonplace.

The present costs of controlling barley grass with 2,2-DPA and with Paraquat are much the same. In general, it is likely to be rather too expensive for some time, except in high return crops or special situations. The higher application volumes required with Paraquat tend to slightly higher costs with this chemical.

On this basis 2,2-DPA will be favoured for barley grass control in lucerne for some time. On the other hand, Paraquat should become increasingly popular for use in subterranean-clover-based pastures, where 2,2-DPA shows undesirable side effects. It may eventually even supersede 2,2-DPA weed control in lucerne. ●

Graze Fodder Sorghums with Caution

Use of sorghum as a stock feed is not entirely without risk.

All members of the sorghum family produce prussic acid in different quantities during their growing period, and this acid is extremely toxic to stock.

Sorghum is a very hardy plant, and is able to provide high yields of fodder during summer and autumn.

Sorghums include Sudan grasses, sorghum almum, sweet sorghums and hybrids such as Sudax®.

Under certain conditions prussic acid is produced by the sorghum in sufficient quantities to cause stock losses.

The toxicity of a stand may be influenced by soil fertility and extremes of heat and cold.

Drought conditions cause sorghum to become stunted and wilted, and prussic acid then may be present at dangerous levels.

Acid may be present in large quantities when the plant is in the growing stage; it is not advisable to graze young growth less than two feet high.

The safest time to graze sorghum is when the plants are in head, but caution should be exercised at all times. ●

® Registered trade name.

MERINOS — HORNED OR POLL?

B. C. Roberts

A poll ram

DOES POLLEDNESS affect the economic factors of wool production, body weight and fertility? The answer to this question is of vital importance to the flock breeder when choosing between horned and poll Merinos.

Horned and poll Merino sheep, experiencing the same conditions of environment, and whose breeding was, on the average, very nearly the same, have been compared. There were no significant differences between horned and poll rams, ewes and wethers as far as production characters were concerned. Poll rams, though, were more resistant to fly strike on the head.

A study of the important economic aspects of wool production, namely, greasy fleece weight, clean fleece weight, staple length, wool count and fold development, showed no significant difference between horned or poll Merinos.

The Author: Mr. B. C. Roberts, Livestock Officer (Sheep and Wool), West Wyalong.

95667—2

Claims that the use of poll Merino rams results in higher fertility were not supported by experiment results both from research centres as well as several commercial properties in New South Wales. This also applied to longevity. Up to the age of 6½ years there was no difference between the numbers of deaths of poll and horned sheep.

Polledness did not affect growth rates, the horned and poll strains not differing in body weights at weaning or at seventeen months of age.

Rams versus wethers

In the course of the above studies a comparison was made of the production and wool characters of rams and wethers pastured together. The rams produced considerably more greasy wool than the wethers, but cut only 6 per cent more clean wool. The rams' wool had a lower clean scoured yield. When the large difference in body size is taken into account the wethers produced nearly 20 per cent more clean wool per pound of body weight than did the rams. This indicates clearly that wethers are more efficient wool producers than rams.

It is generally believed that rams grow stronger wool than wethers. However, when these rams and wethers were run together the rams' wool showed finer crimping than the wethers' fleeces.

Polledness and "cryptorchism"

"Cryptorchism" is a condition where one or both testicles are retained in the abdominal cavity. This means that male sheep with this condition cannot be properly castrated and therefore become "rigs".

In Russia and America this condition has been shown to be closely linked with polledness. In these countries selection for polledness has increased the percentage of cryptorchid rams born.

In Australia, information is not available to decide whether cryptorchism is linked to polling or whether it is the result of the close breeding sometimes associated with breeding poll sheep.

Sales of poll Merino rams

The number of poll Merinos in Australia has increased in the last twenty years. To what extent is hard to define because the sales of horned and poll rams have only been recorded separately for the last four years. In 1963, 7 per cent of rams sold in Australia were polls (see table).

However, the figures for sales in Australia during the four year period 1960 to 1963 do not indicate any major trend in the popularity of the poll Merino. In New South Wales the percentage of poll rams sold is steady at approximately five per cent.

Sales of horned and poll rams

Year (ending 31 Dec.)	Horned rams sold	Poll rams sold	Poll rams sold as a percentage of total rams sold
NEW SOUTH WALES			
			per cent
1960	99,687	5,077	4·8
1961	98,272	4,220	4·0
1962	99,779	5,279	5·0
1963	107,501	5,727	5·0
AUSTRALIA			
			per cent
1960	179,710	11,232	5·9
1961	187,675	10,926	5·5
1962	199,949	13,245	6·2
1963	213,255	16,097	7·0

Source: Australian Stud Merino Register

A horned ram

Conclusion

Where Merino sheep differ only with respect to the poll character, this factor does not affect production.

However, selecting for an extra character, polledness is a disadvantage as it causes a temporary reduction in the rate of improvement of wool production until polledness becomes well established in a flock.

Therefore, Merino ram breeders do suffer some reduction in wool production while establishing a poll strain, caused by this lowered rate of improvement.

This important implication is passed on to the Merino flock breeder purchasing poll rams.

Exchanging a reduction in wool production per head for fewer head strikes in rams is not economically justified, especially when it is considered that:

- The size of the ram flock is only relatively small compared to the total flock (usually two rams per 100 breeding ewes).
- Prevention of head strike in rams is not difficult with the use of modern insecticides.

In the pastoral areas, protection of rams from fly strike is more difficult. Polled rams may have an advantage under these conditions but this suggestion is not supported by the results of one experiment carried out at Wentworth.

Personal choice plays a major part in a flock breeder's decision as to whether he uses poll or horned sires. As on present evidence there is no difference in production between these two types of Merinos, no definite recommendation can be made. When buying rams, the breeder should remember that he is buying Merinos and concentrate on assessing and demanding a high standard in their productive characteristics.

ACKNOWLEDGEMENTS

This article is based on the papers presented by Dr. R. B. Dun and Mr. C. H. S. Dolling at the Poll Breeders' Convention, held at the Agricultural Research Station, Trangie, N.S.W., May, 1962; the paper "The Influence of the Poll Gene and of Castration on Production Characters of Male Merino Sheep" by R. B. Dun, published in the *Australian Journal of Experimental Agriculture and Animal Husbandry,* Volume 3, No. 11, November 1963; and the paper "The Poll Merino" by C. H. S. Dolling, published in the *Journal of the Australian Institute of Agricultural Science,* Volume 25, No. 2, June, 1959. •

Kurrajongs Are Good Investment

Increasing interest in establishment of kurrajong trees, particularly on Western Division properties, indicates a growing realisation of their value.

Kurrajongs are extremely drought resistant and long-lived, and their foliage is eaten readily by stock.

Seeds may be collected in May or June, for a September sowing into seed beds.

Methods of propagating and establishing the trees are described in a leaflet, *The Kurrajong,* now available free to all in New South Wales from district offices of the Department of Agriculture, and from Head Office. •

Systematic Maintenance of Farm Machinery

W. H. FINLAYSON AND J. G. DREVER

LACK OF MAINTENANCE on farm machinery can greatly increase the overall maintenance cost. It is the greatest single factor contributing to machinery breakdowns, and can mean the difference between harvesting and losing a whole crop.

On a wheat farm the value of the machinery could be in excess of £10,000. With this capital outlay, a good farmer should always have his machinery ready for use at any time. When the machinery is new, it usually functions well, but it doesn't take a great deal of use for a machine to start to wear—in fact this process starts from the moment the first revolution is turned or the first stroke made. Maintenance retards wear and helps to decrease the rate of depreciation of the machine. It follows that if wear is to be cut down, then maintenance must start immediately the machine comes on the farm.

Work equivalent

With farm machinery it is often difficult to understand just how much work the machine has done. Perhaps the best way to appreciate this is to relate the hours worked to distance travelled in, say, a motor car. A tractor engine under average working conditions would operate at an equivalent speed to that of a motor car travelling at about 50 miles per hour. At the end of a ten-hour working day, the farm tractor would have done equivalent work to that of a car having travelled 500 miles. From these figures it is not difficult to see that although the hours worked by the farm tractor may seem rather small, the work done is quite considerable.

Effective planned maintenance

If the rate of machinery wear and depreciation is to be slowed up, an effective planned maintenance programme must be carried

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out on each machine on the farm. It must fit in both with the requirements of the machine and the farming programme. The importance of these two items will vary from time to time and from machine to machine, and for this reason a great deal of thought has usually to be given to planning. The programme finally evolved should be flexible enough to allow for emergencies. Only in exceptional circumstances should farm activities be allowed to interfere unduly with necessary maintenance or repairs, for this can lead to costly repairs or unsafe machinery, or a broken-down machine.

Effective machinery maintenance and general farm efficiency go hand in hand. If a farmer is too conscious of machinery maintenance and spends too much time fiddling about with machines, other farm enterprises suffer. On the other hand, too little maintenance can often mean the failure of some farm enterprise, because the machinery is not in working order at a critical time like harvest. Effective maintenance must be well planned and in balance with overall farm management.

Maintenance intervals

Regularity in maintenance is of the utmost importance.

In many cases the manufacturer of the particular machine sets out some form of guide as to the most desirable intervals. The majority of manufacturers prefer to use intervals of 10 hours between maintenance operations, because it is easy for the operator to think in terms of tens, and also because the interval of time is satisfactory for the efficient operation of the machine.

Most tractors these days have hour meters fitted as standard equipment, and this makes it easy to carry out scheduled maintenance.

On engines which do not have an hour meter it is not quite as simple to record the work done in terms of hours. Perhaps the best way to record the use of such items is to note the fuel used. If the farmer were to measure accurately the fuel used by the machine in one hour, it would be possible to relate accurately the fuel used to the hours worked. The task of measuring fuel into a particular machine may appear to be rather a laborious waste of time, but it is a method employed by many earth moving contractors, shire councils, and Government authorities.

Recording machinery maintenance

Accurate records for each machine, showing hours worked, fuel used, and oil used, and general maintenance records for such things as oil changes, filter changes and air cleaner service, are invaluable in assessing running costs. They help also in predicting when repairs might be necessary.

There are many ways of keeping such records, but usually the method adopted boils down to individual taste and ability. Most oil companies circulate tractor log books or cards for recording the necessary figures. If there are only one or two motorised machines on a farm then possibly a log book for each machine would be ideal. On the other hand, if there are several engine-functioned machines or stationary engines then possibly the best method of recording would be on a card system using one card for each machine. No matter which method of recording is adopted, it is only as effective as the person doing the maintenance and the recording.

Tractor log books provide the operational, maintenance and repair history of the tractor. It is a ready-made means of knowing more about it. Log books should show daily hours worked, implements used, fuel and oil additions, regular lubrications, regular preventive maintenance, repair maintenance and replacements, such as fan belts, batteries, filters and tyres like the accompanying specimen sheet.

All these jobs require no more than a daily five-minute notation in the log book, yet the information provided enables easy checks for excessive fuel or oil consumption by the tractor, also such items as excessive tyre wear can be noted, for the log book will show the period between replacements. Log books could be called reference books, for when used as such they take the guesswork out of operating costs and provide definite reminders regarding correct maintenance.

TRACTOR LOG SHEET FOR MONTH.................... MAKE.................... MODEL....................

DATE	DAILY REMINDERS								Hours Worked	Time Spent Servicing	PRODUCTS USED				NATURE OF WORK	MAJOR OR MINOR REPAIRS		
	Grease	Air Cleaner	Oil Level	Water Level	Battery	Tyres	Brakes	Fuel			Oil (pints)	Kerosine (galls.)	Distillate (galls.)	Petrol (galls.)		DESCRIPTION	COST	REMARKS
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TOTAL																		

Trans. Oil Changed.................... Date.................... Filter Replaced :—(Oil).................... Date

Radiator Flushed.................... Date.................... (Fuel).................... Date

TRACTOR MAINTENANCE

Tractor maintenance can be identified within two groups:

Preventive maintenance, which includes lubrication, checking, servicing and adjusting components, and

Repair maintenance, which involves adjustments of a skilled nature and major overhauls.

The following maintenance schedule could be used as a blueprint for any standard type of medium class wheeled tractor, whether diesel or petrol, provided it is used for more than 600 hours per year.

Preventive maintenance schedule

A tractor should be kept clean. Wash it down once a week when it is being used. It should be kept free of oil, water, fuel and acid stains, all of which damage the paint, which has been put on to prevent rust and corrosion.

Every 10 *hours or daily*:

At the start of the working day—

Check engine oil level.

Check radiator water level.

With tractor stationary, run engine at 2/3 throttle for 3 to 5 minutes, checking oil, temperature and ammeter gauges.

Then listen, look and check—

Listen for unusual noises at the motor or clutch.

Look for water, fuel and oil leaks.

Look for unusual smoke from exhaust pipe.

Check tyres visually—looking for damage at valve cores, side walls and bar treads.

At the end of working day—

The air cleaner and pre-cleaner should be serviced. If oil-bath type of engine cleaners are fitted, change, clean and refill oil cup to correct level, if necessary. In very dusty conditions, do this service at least twice daily.

Greasing and lubrication—

Grease steering linkage and front axle joints. Any other specific daily grease points mentioned in the tractor's handbook should be given attention. Unless otherwise indicated in the handbook, the purpose of all grease gun applications is to renew and not add grease to the lubrication points. If the tractor has been engaged on work involving an unusual number of turns, for instance in a small orchard or vegetable garden, grease the steering joints twice daily.

Check the level of the fuel in the tank. Evening fill-ups should preferably be done in a sheltered spot. Avoid accumulations of water in fuel tanks. This results from overnight condensation of dew inside a partially filled fuel tank. This water can damage the engine. After putting the tractor in the shed, record the day's activities and times in the log book.

Every 50 *hours* (*or weekly*)—plus daily maintenance.

Check tyre pressures; the minimum requirement for any tractor is 12 p.s.i. (pounds per square inch pressure) in rear tyres and 28 p.s.i. in front tyres.

Check wheel nuts and studs all round for looseness and damage.

Check oil levels in gear box, rear axles and final drive gear housings.

Every 100 *hours* (plus daily and 50 hours maintenance).

Change engine oil, grease all points indicated in the handbook as "periodic"—such points are generally the water pump, foot controls, rear axle bearings and underslung drawbar assembly. Clean battery, tighten terminals, and check battery-water levels. Some grease points have most specific recommendations regarding the number of grease gun applications necessary. If a manufacturer recommends "two applications of the grease gun," follow his recommendations—apply no more and no less. Overgreasing at these points could ruin oil seals and damage clutch friction plates.

Every 200 *hours* (plus daily, 50 and 100 hours maintenance).

Clean and wash down tractor all round; change engine oil filter cartridge; check steering box oil level and service air cleaner completely. To do this, remove, dismantle and clean it out thoroughly, then refill the oil pan. Check engine fan belt for condition and tension, specially looking for cracks, frayed edges or worn sides. Check the belt tension adjustment—this usually permits ½ in. free play between pulleys. Lubricate armature bearings in the generator, checking mounting bolts for tightness. Check and clean fuel gauze strainer and sediment bowl. Check hydraulic oil levels, when applicable.

Every 400 *hours or half yearly* (for example, May and November), plus daily, 50, 100 and 200 hours maintenance.

Check engine oil strainer in sump.

Drain, flush and refill water cooling system, checking radiator tanks, core, hoses and filler cap for damage or wear. Remove, clean and lubricate tachometer drive cable (when applicable). Check and clean breather points at crank case, fuel filler cap, governor, hydraulics and transmission. Check brake adjustments for efficiency and evenness. Check clutch pedal adjustment. Have governor checked for recommended revolutions per minute (r.p.m.) at idling speed and maximum no-load speed. Give the tractor a general tighten up—particularly at radiator, rear end of tractor, and around seat, dash, bonnet and wheel guards.

Check engine valve clearance settings.

In tractors with petrol engines:

Renew spark plugs,

Service ignition distributor and wiring, and

Remove, clean and re-adjust carburettor.

In tractors with diesel engines:

Service fuel injectors (preferably fitting exchange units),

Renew fuel filter cartridges,

Check governor coupling for wear,

Check fuel pump oil level (if applicable), and

Reprime fuel system.

Every 800-1000 *hours or once yearly*—plus daily, 50, 100, 200 and 400 hours maintenance.

Drain and refill gearbox, transmission and belt pulley oils.

Remove, clean, re-grease and re-adjust front wheel bearings.

Remove thermostat from cooling system and check it.

Check engine timing—ignition timing with petrol engines; fuel pump timing for diesel engines.

All maintenance should be considered as an "end of day" job.

Experience has shown that the most frequent maintenance deficiencies are irregular oil changes, dirty air cleaners and crank case breathers, neglected batteries, excessive engine speeds, improper engine valve adjustments, poorly adjusted brakes and low tyre pressures.

All of this preventive maintenance can be done by the tractor operator. Regular and correct maintenance prevents premature breakdowns, reduces fuel bills and extends tyre life, and apart from any other advantages gained, these three items reduce running costs considerably.

Similar schedules should be drawn up for all major items of machinery. Manufacturers supply details of these in their handbooks.

Workshop accommodation

Machinery maintenance carried out without proper facilities or knowledge may often be as detrimental to a machine as if there were no maintenance at all.

To some farmers, a well equipped workshop and machinery shed seems to be a waste of time and money. To other farmers, a machinery storage shed is quite the logical building to have, however they find it hard to realise the advantage of having a well equipped workshop. All farms where machinery is used should have some form of workshop facilities if machinery maintenance is to be effective and economical. The better the facilities the more economical the maintenance will be. A Departmental booklet, *Farm Machinery Workshop and Storage Buildings,* is available.

Workshop equipment

The type of equipment required in a farm workshop will depend on the extent of the maintenance the farmer wants to do. If a farmer decides that he will do only preventive maintenance, then he will require less equipment than the farmer who decides that he will do repairs as well as preventive maintenance.

"Will I do machinery repairs or not?" This is a question which many farmers ask themselves almost every year. The answer depends upon the farmer's own ability. Some farmers are born mechanics and are able to undertake even the most complicated repairs and complete the job in a tradesman-like way in a short time. Others cannot undertake repairs without finding a great deal of difficulty and wasting a great deal of time. The answer also depends on the effect the time spent on machinery repairs will have on other farm enterprises. Between-season repairs is often the answer for one who is not very confident.

The question of just what tools are required is one that is difficult to answer because the requirements will differ from farm to farm, depending upon the enterprise undertaken on the farm. A Departmental booklet, *Tools and Equipment for the Farm Workshop,* is available for guidance on the selection of tools.

On a number of farms today one may find tractors which are upwards of 20 years old and still in excellent condition and still in regular use. Some people say, "They don't build tractors now like they did in the old days." The answer to this is that there are comparatively few old tractors still in

use compared with the number built. The reason why there are old tractors in good condition still in use is because, during their life, they have been given the necessary maintenance.

Because of the advanced techniques which we employ in farming today, there comes a time when it is no longer economical or expedient to operate an old machine. There is an optimum time at which one should dispose of a piece of machinery. Whether a machine is new or old, it will still require maintenance. The number of repairs required will depend on the way in which preventive maintenance is carried out. There is a point in the life of any machine where it is no longer economical to carry out the required repairs. By keeping accurate records of fuels, oils, maintenance and repairs of motorised machines it is possible to predict the point at which a machine should be disposed of or withdrawn from service.

There are three mains reasons, from a mechanical point of view, why a machine should be replaced:

- The machine is obsolete and is no longer capable of adequately carrying out the required function,
- The machine is not large enough to carry out the operations required of it, because of the current farm programme, and
- It would be uneconomical to carry out further repairs on the machine.

By continual checking of general farm management records and machinery service and maintenance records it is possible to reach a business-like decision as to when a new machine should be purchased.

Landholders who do not carry out effective machinery maintenance and who do not keep good records usually trade used tractors for new ones long before such a trade-in would normally be necessary. ●

Use Trifoliata Stock on Old Citrus Land

Orange trees planted on land previously used for citrus should be on trifoliata rootstock in preference to rough lemon or sweet orange stock.

Trifoliata stocks are more resistant to harmful soil organisms that carry-over from earlier plantings.

Soil organisms attack the roots of new trees, preventing the trees from growing and producing as they should.

Good management often prevents this effect being apparent for the first two or three years.

But the trees will fluctuate in condition and appearance from one part of the season to another.

The overall effect is one of decline which increases until about the twelfth year.

The trees then become decidedly poor, both in condition and production.

In plantings on old land, when rough lemon stocks are used, lemons usually do much better than oranges.

Why this is so is not clear, and it does not mean that lemons will always be successful on old land.

Trifoliata rootstocks are not recommended for lemons. ●

Normal cow

BLOAT IN CATTLE

J. S. Healey

BLOAT is one of the major health problems of cattle throughout the world. It occurs when gas accumulates in the rumen (paunch) and cannot be eliminated by belching.

There are four principal types of bloat.

Frothy bloat is caused by eating legumes such as lucerne and clover. This type accounts for almost all cases of bloat in New South Wales.

Feedlot bloat, which is relatively common in the United States, is rare in Australia. It only affects cattle heavily fed on concentrates.

Obstruction bloat is caused by solid masses of feed, such as potatoes, becoming lodged in the gullet and so preventing the normal elimination of gas from the rumen by belching.

Bloat as a sequel to milk fever.

Nature of frothy bloat

Bloat is likely to occur when cattle eat lucerne or clover, especially if the growth is young or is eaten quickly by hungry cattle. On the other hand, the risk of bloat is greatly reduced if grass is mixed with clover in the pasture sward, so that cattle are continuously eating a mixture of the two species.

The proportion of grass necessary to prevent bloat varies. Normally, if cattle can obtain 50 per cent grass in each mouthful of feed, the pasture may be considered safe. However, bloat has been known where pastures contained as little as 30 per cent clover. To prevent bloat, the grass and clover need to be well mixed, otherwise the clover may be selectively grazed.

Much research has been conducted in an effort to determine why legumes are so bloat producing. However, the full picture has not yet emerged. In the normal process of digestion in the rumen, fermentation of feed takes place, with the production of

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large quantities of gas. Up to 120 gallons of gas may be formed each day. Normally the animal gets rid of this gas by belching. In bloat, however, the gas becomes trapped in the form of numerous bubbles within the feed mass, producing a froth, or foam. This foam becomes relatively stable, and cannot be eliminated.

Cow affected by bloat

It has not been determined exactly what it is in legumes that causes foam. Research has tended to incriminate pectic substances, but proteins, saponins and fats are not in the clear. An interesting discovery has been that when clover is being eaten, the amount of saliva secreted by a cow is very much less than when grass is eaten. The saliva of the cow has been shown to contain a mucin which tends to stop foam formation, and which assists the liberation of gas. It therefore appears that reduced salivation when eating lucerne and clover may be important in promoting bloat.

Legumes in the form of hay are usually safe but cases of bloat following the feeding of this type of fodder have been known. The feeding of hay immediately before cattle are given access to leguminous pasture reduces to some extent the likelihood of bloat.

Symptoms

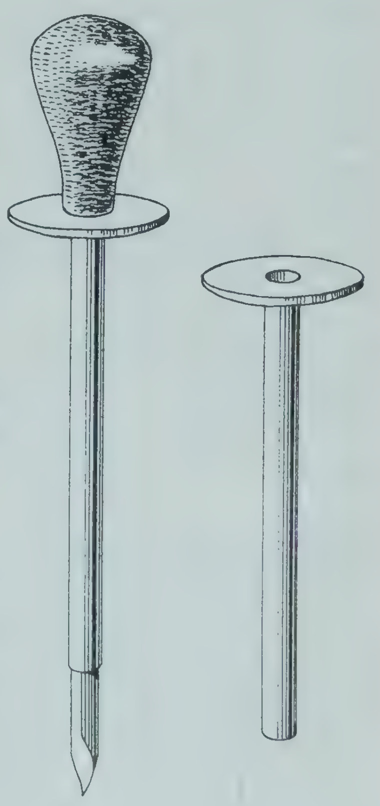
The speed of the onset of bloat is highly variable. It can come on suddenly, at times within 15 minutes of cattle being turned into a paddock. On the other hand it may develop slowly.

The first indications of bloat are a swelling of the left side of the abdomen and evidence of discomfort. As the condition becomes more advanced the abdominal swelling increases, with the skin finally becoming tense and drum-like. Breathing becomes increasingly difficult until the animal gasps, with the mouth open and the tongue protruding.

At this stage, death is likely within a few minutes unless relief is given. In extreme cases death can take place within 30 minutes of access to leguminous pasture.

Post mortem

The most characteristic post mortem findings are intense inflammation of lining of the trachea (windpipe) and pallor of the liver through expulsion of blood from that organ. The foam within the rumen subsides after death. Thus where an animal has been dead for any length of time, there may be no evidence of bloat.



Left: Trochar covered by the cannula. Right: the cannula, through which gas can escape from the rumen.

Distinction from other diseases

Cattle found dead from bloat may resemble those dead from enterotoxaemia, blackleg or black disease. Investigation by a veterinarian may then be necessary to determine the cause of death.

Puncturing the rumen with the trochar and cannula; site of puncture is shown clipped, but there isn't always time for clipping.

The main point of distinction is usually the liver. It tends to be pale in bloat but dark and congested in the other three diseases. Furthermore, in black disease, the liver although generally darkened contains one or more pale areas. However, the liver may have to be incised before these are visible.

In blackleg, manipulation of the carcass will usually reveal an area where gas and bubbles of fluid can be felt under the skin. In light-skinned animals this area takes on a dark colour. Furthermore, blackleg is usually confined to cattle under two years of age.

Treatment of bloat

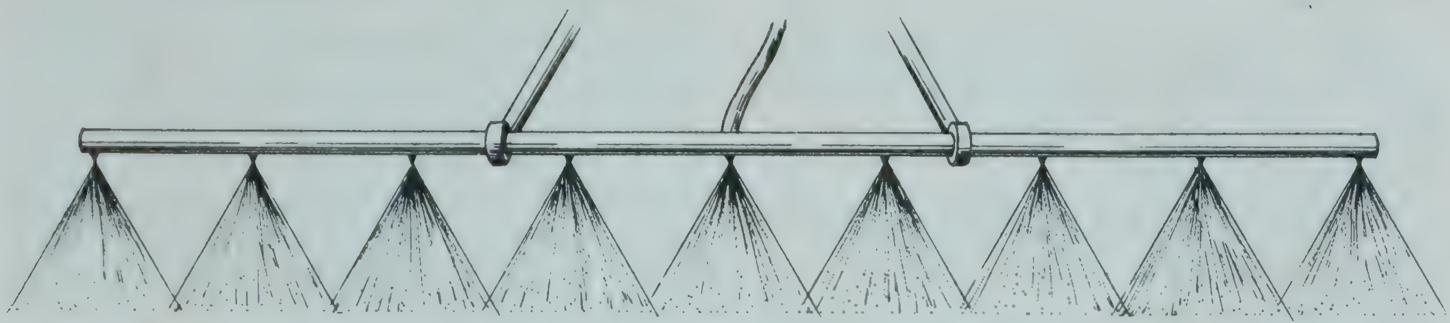
A variety of treatments have been employed in the past. Procedures which may be successful in mild cases consist in tying a stick in the mouth like the bit on a horse bridle; standing the cow with the front feet raised, or smearing Stockholm tar on the back of the tongue. These methods encourage the liberation of gas from the rumen. However, the only reliable treatments are administration of antifoaming agents, and surgical intervention.

Antifoaming agents. The most effective antifoaming agents are certain detergents and oils. The latter may be either vegetable or mineral. Of these the most efficient is the detergent Pluronic L-62, which is given as a drench in a dose of 1 fluid ounce. However, because this particular detergent has such value in the treatment of bloat it must not be supposed that all detergents act similarly; some are of no use.

The oils are also highly effective, but any oil irritant to the stomach should be avoided. The most suitable are peanut oil, raw linseed oil, olive oil, liquid paraffin and proprietary mineral oils prepared specially for bloat. A dose of 4 to 8 ounces of such oil should be administered as a drench to an affected cow.

Instead of dosage by mouth the Pluronic L-62 or oil may be injected directly into the rumen by means of a syringe and large-bore needle. Either kerosene or oil of turpentine will usually relieve bloat, but both have the disadvantage that they are irritant to the membranes of the mouth and stomach. However, they may be employed if more suitable remedies are not available.

Other treatments which have been successful are the administration of polymerised methyl silicone, or a drench of 1 fluid ounce of formalin in 2 pints of water.



Booms must be high enough for the cones of spray to overlap

Surgical treatment. In advanced cases the administration of antifoaming agents may fail to give relief before death occurs. If this seems likely to be the case, it is necessary for the rumen to be punctured to allow the gas to escape. The instruments specially designed for this operation are the trochar and cannula, but if these are not available a sharp knife can be used. The cannula is a hollow metal tube through which fits the solid metal trochar whose extremity is sharpened to a point to permit penetration through the hide and into the rumen. When the trochar and cannula have entered the rumen, the trochar is withdrawn leaving the cannula in position. The gas should then escape through the cannula.

The place to puncture is midway between the last rib, the point of the hip and the edge of the loin bones, insertion being made in a forward and downward direction towards the elbow of the front limb on the opposite side. When much free gas is present its escape from the stomach is very fast, but as the contents of the rumen are usually mixed with the gas the escape is not so rapid.

If after puncture the gas does tend to escape very rapidly, the outlet of the cannula should be partly blocked with the thumb to control the rate of flow. The sudden collapse of an enlarged rumen may lead to death from shock. Very often, however, the escape of gas is prevented by the blocking of the cannula with plugs of feed. These require to be pushed back into the rumen with the trochar.

Following the escape of the gas an antifoaming agent of the type previously described should be poured directly into the rumen by attaching a rubber tube and funnel to the cannula. After the cow has recovered the cannula is withdrawn. The wound caused by its penetration will contract and ultimately heal.

If sufficient gas does not escape through the cannula and death seems imminent, drastic surgery must be resorted to. A large incision has to be made with a knife into the rumen, at the point of entry of the cannula. Then, enough of the ruminal contents to relieve the animal is removed by hand. There is a real danger that this treatment will cause peritonitis and subsequent death. However, the action is justified as an alternative to death from bloat. As far as possible when removing feed from the rumen in this way every effort should be made to prevent the contents from contaminating the exterior of the rumen and the wound.

If it has been necessary to incise the rumen, a veterinarian should be called as soon as possible to disinfect and suture the wound, and provide follow up treatment. If this cannot be arranged, the wound should be thoroughly cleaned by swabbing with a mild disinfectant. The walls of the rumen should then be tightly sewn together, with the cut edges protruding inwards. The muscles are next sutured and finally the skin, leaving an opening in the skin about 1 inch in length at the bottom of the skin incision to permit drainage. Prior to undertaking this suturing, the needles and suture material should be thoroughly boiled for 15 minutes and kept in a non-irritant disinfectant solution until used. The operator's hands should also be disinfected.

Prevention

Experience has shown that certain practices can provide varying levels of protection against bloat. These are:

- Grazing control;
- Administration of antifoaming agents;
- Administration of antibiotics.

Grazing control. As the risk of bloat is greatly reduced when cattle are able to take in enough grass with each bite, a desirable aim is to prepare swards in which the proportion of clover does not exceed 50 per cent. In New Zealand it has been found that grazing a pasture in very narrow strips often only a foot wide gives partial protection. The fence is not moved to permit the next strip to be eaten until the first strip is completely eaten down.

The feeding of roughage prior to turning the cattle on to clover reduces the risk of bloat but is not a reliable preventive. Where cattle are turned into pastures likely to produce bloat they should be under observation and the herd removed as soon as suspicious symptoms appear.

Dangerous clover or lucerne is made somewhat safer by cutting and feeding next day.

Administration of antifoaming agents. Pluronic L-62 administered as a drench (1 fluid ounce per cow) has been shown to give 24 hours protection against bloat. Oils given in the feed or as described in the section on treatment can be relied on to protect for only two to four hours. Some cattle owners, however, have claimed longer protection.

Pasture spraying. The best way to give oil to prevent bloat is to spray it on the pastures in the form of emulsion. This provides a relatively uniform concentration of the oil in the rumen while dangerous pasture is being grazed.

Pasture spraying can only be done on properties reasonably well subdivided and where the cattle can be confined to small areas by means of an electric fence. Peanut oil was originally used but has now been superseded by less costly, proprietary, non-irritant oils, or tallow. Oil must be emulsified with water and a wetting agent before being applied to pastures. Tallow, which is relatively cheap, may alternatively be used but is more difficult to emulsify. Particulars of the method of emulsification may be obtained from the Department of Agriculture.

The risk of bloat is greatly reduced if grass is mixed with clover in the pasture sward

The area which it is assumed the cows will eat down in 24 hours is sprayed with the emulsion at the rate of 3 ounces of oil or fat per cow. Pasture can be treated up to three days ahead. It is an advantage to have pasture treated in advance, as emulsion applied during wet weather may not be successful. However rain, unless exceptionally heavy, does not interfere with emulsion that has dried on pasture.

When dangerous pasture is being treated for the first time it is advisable to spray at about 6 ounces of oil or fat per cow for the first two days. The area to be provided needs to be conservatively estimated since the spraying of too large an area will allow the emulsion to spread out excessively. If this occurs, not enough oil may be taken in by the cattle while grazing. The cattle must be confined to the treated area, and back grazing over all land not recently treated needs to be prevented. Two separate electric fences are advisable for this purpose and should be so arranged that the pasture which the cattle can reach under the fence is treated. Each day's grazing is best fed off in three or four separate strips.

It is most important that the emulsion be evenly distributed over the pasture. A boom spray is therefore ideal for application. However, care is necessary to ensure that no strips are missed in the spraying. The boom must also be high enough for the cones of spray to overlap. Alternatively, a boomless jet spray can be employed, but it gives a less uniform distribution of emulsion. When small numbers of cattle are involved a knapsack spray is suitable.

Administration in drinking water. The administration of oil by maintaining a layer on the surface of water in troughs has been attempted but found unreliable. Pluronic L-62 can be readily mixed with water but makes drinking water extremely unpalatable. However, if no other water is available cattle will drink water so treated after three days of perseverance.

In trials, Pluronic L-62 administered in drinking water at a level of 1 fluid ounce per 20 gallons of water gave complete protection against bloat. Stock must not of course have access to untreated water.

Antibiotic administration. Certain antibiotics given by mouth will temporarily protect against bloat. The most efficient of the antibiotics in this respect is penicillin. Experience has shown that 100,000 to 200,000 units of penicillin administered at intervals of two to three days will prevent bloat. Following the first administration, cows are not protected for some eight to twelve hours. A disadvantage of penicillin is that after about three weeks continuous administration is has no effect. In giving penicillin to cattle it is best to mix it with a small quantity of feed which has been damped down. Individual feeding is necessary to ensure that each cow receives the requisite quantity of penicillin.

Research

Bloat is the subject of comprehensive research in many countries. Among the aspects of the problem being studied are the biochemical processes involved in the formation of stable foam in the rumen, and methods of prevention.

Unfortunately it has not yet been possible to evolve a satisfactory preventive for properties where intensive husbandry is not practised. •

The Shannon Vale Story

R. D. EASTOE

TO SHANNON VALE NUTRITION STATION can be attributed the modern Australian approach to pasture utilization. Information has been obtained and evaluated at the Station over 20 years. The knowledge available is now adequate, and the main requirements for any property are finance, and the ability to put knowledge into practice.

Although Shannon Vale is on the northern tablelands, a summer rainfall area, the pasture principles developed there have application wherever pasture improvement is possible in Australia.

Allied work has been done at other research centres, and some of Shannon Vale's techniques have been modified. Such work has contributed to the wide use of the Shannon Vale results.

The problem

The soils of about six million acres of the eastern slopes of the northern tablelands are poor granites. Natural pasture species

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provide satisfactory feed in the summer months, but in winter are mainly worthless fibre.

In the 1930's, sheep on the granite soils could not maintain their numbers by natural increase. Graziers could not depend on breeding for replacement; they were losing more sheep than reached maturity. The death rate was heavy also in mature sheep. and growth of surviving weaners was poor.

In 1936 Mr. J. C. Cotsell became the first sheep and wool officer appointed to the Glen Innes district by the Department of Agriculture.

With co-workers he attempted to solve the problems of poor growth, low production and high mortality in sheep, locally known as "poorness of blood". Licks were tried first but were of no avail.

However, supplementary feed did change the health, growth and numbers of surviving sheep and showed that the fibrous winter pasture lacked sufficient feed value for maintenance. Poor nutrition was accentuated by internal parasites.

Improved nutrition

Early work with licks and supplementary feeding was done on a private property at Bald Knob, not far from the present Station. In 1940, 600 acres for Shannon Vale Nutrition Station were leased (and later purchased) and feeding trials were continued there until about 1942. During this time some small areas of pasture were sown. Supplementary feeding, while successful, was expensive, and the ratio of feed costs to wool return was too high.

Pasture species sown in the beginning of the 1940's were phalaris, perennial rye, and white, subterranean and red clovers, with one hundredweight of superphosphate per acre. In later establishments, cocksfoot was added and subterranean and red clovers were no longer sown.

Natural pastures would not support more than about two sheep to three acres, and Cotsell's figures showed a wool yield of only 5.6 lb. per acre. The carrying capacity and wool yield of the sown pastures was much higher and improvement continued. *Present figures are up to 12 sheep per acre and a top yield of 132.5 lb. of wool per acre from one unit. In 1964 the 600-acre property carried 3,300 sheep and averaged 48.8 lb. of wool per acre.*

The improved pasture made such a difference to health and production of dry sheep that Cotsell's attention was turned to further increasing production. He was not content merely to supply, or over supply, sheep with good quality feed.

Rationing pasture

Unrestricted feed was not necessary, and the stage had been reached where some control over feed consumption was desirable.

Sheep constantly fat are pleasing to a stockman's eye, but Cotsell's contention that this was inefficient use of available feed was well supported by his 1940-2 rationing trials with dry sheep.

In these trials, sheep grazing on improved pastures for five days a week grew only 0.6 lb. more wool per head than sheep on improved pastures for only two days a

Comparison of Grazing on Improved Pasture and Natural Pasture

Time per Week Spent on Improved and Natural Pasture	Wool Production per Head	Percentage Increase over Natural Pasture Only
	lb.	
5 days improved, 2 days natural ..	9·00	12·5
2 days improved, 5 days natural ..	8·40	11·2
Natural pasture only	7·46	....
	per Acre lb.	
5 days improved, 2 days natural ..	12·21	118·0
2 days improved, 5 days natural ..	7·68	37·1
Natural pasture only	5·60	....

week. From this small difference it is evident that restricted grazing is the more economical use of improved pastures.

The increased per acre return was largely attributable to the ability of sown pasture to carry sheep at a higher stocking rate.

Growing young sheep

In 1943 a mob of 3½- to 5-months-old weaners were bought and the rationing technique again applied. This time sheep with half a week on sown pasture at two per acre and half a week on natural pasture at three-quarters of a sheep per acre were compared with sheep on native pasture alone. The group with some sown pasture was well ahead in body weights. During the second year the natural pasture group was given a supplement of hay and grain in an endeavour to bring body weights in line with the group spending half their time on improved pasture. The supplement failed to achieve this.

Merino breeding

Breeding was not economic on natural pastures on the granite soils. Further, it was usual in the district for lambing to take place in September. With the better feed situation from improved pasture at Shannon Vale, lambing in September was compared with lambing in November.

The spring flush of feed commences in October; the lowest pasture production is in July and August. With September lambing, the stresses of the later end of pregnancy occur in the period of lowest pasture production—natural or improved. Cotsell's move to November lambing meant that the breeding ewes increasing nutritional needs coincided with the increasing pasture growth. This is the simplest possible means of defeating pregnancy toxaemia.

From the observations of the breeding trials the following features are worthy of note.

- There were twice as many deaths of September lambs as of November lambs.
- Pasture rationing was still used for one September and one November lambed group—3½ days of improved and 3½ days of natural pasture. The progeny of these two groups were fit to mate at 18 months. Local practice was to mate at 2½ years because of the poor growth.
- The groups fed on improved pastures increased in numbers five fold in six years. The two groups restricted to natural pasture failed to maintain themselves.

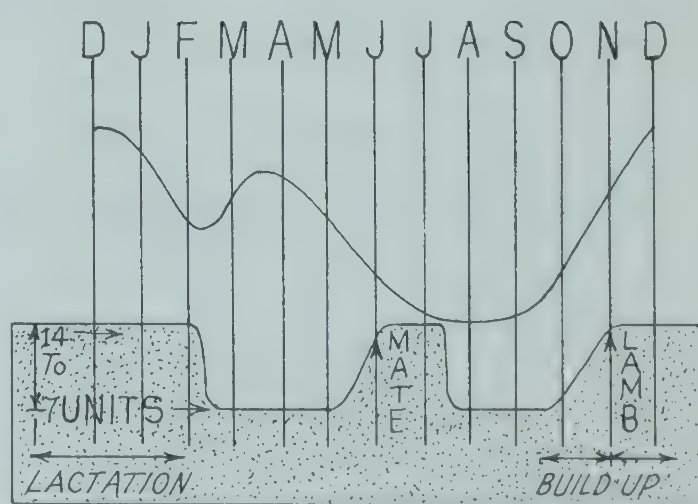
Further breeding was undertaken in 1951, one group being fed on improved pasture all the time, and the other group only half the time. This time differing stocking rates were tested.

As would be expected, the ewes on full time improved pasture cut better (¾ lb. more wool per head) than did the other group. Their gross return per acre was three times greater because of the difference in stocking rates—£11 3s. 0d. per acre for the seven day group—£3 16s. 0d. for the 3½ day group. (1956-7 prices.)

Pasture-stock relationships

On face value the foregoing figures would favour extended or even full time grazing on good pasture and many quite heavily stocked properties practise this. Cotsell contended that unrestricted feeding all the year was a waste of feed.

From this was developed the principle of "feed the sheep according to their needs" and a system he labelled "strategic grazing".



The management programme at Shannon Vale, showing the relation to pasture growth.

The only sheep needing unrestricted feed are weaners, to take care of body growth through their first year. Lambs are weaned at three months and placed in paddocks that have been saved for the purpose. Even breeding ewes do not need more than six months on good feed. This is during periods of stress—six weeks of mating, build-up during the last six weeks of pregnancy, and during lactation. Apart from these stress periods, breeding ewes can be treated as wethers and allowed to graze areas that have been "topped" by weaners with first priority to high protein feed.

Strategic grazing

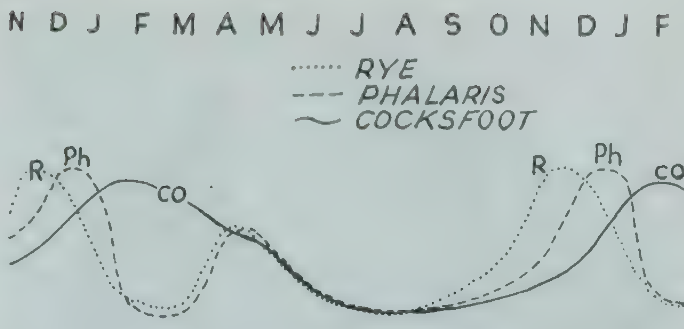
Just as important as feeding sheep according to their needs is to make sure of pasture growth. To have growth, root development is necessary. Root growth will not be strong unless there has been a period of leaf growth. Constant stocking does not allow this, so paddocks at Shannon Vale are grazed in short bursts at very heavy stocking rates and then allowed to rejuvenate for lengthy periods. The strategy of short, heavy grazing periods is to decide a frequency and timing of grazings suited to the productivity and the growth pattern of the pasture species.

At the beginning of the year each paddock is allotted a grazing sequence—when sheep go in, when they come out, and the number that will graze it. This plan is recorded on graph paper and is adhered to.

Pastures

Superphosphate applications were increased from 1 to 2 cwt. on sown pasture. Cotsell experimented with very heavy applications to obtain quicker use of sown paddocks. On some areas he sowed pasture seed with 4 cwt., followed in spring and autumn with another 2 cwt., that is, 8 cwt. in one year. But he had a fully established pasture under full grazing within that twelve months.

To extend the period when growing grass would be available, Cotsell turned from mixed pastures to single species sowings. Each paddock was sown to a single grass species with white clover. He could use the differences between the growth habits



Annual growth curves of ryegrass, phalaris and cocksfoot at Shannon Vale.

of phalaris, rye and cocksfoot when they were in separate paddocks. They could be grazed when making most growth without damaging the other grass species, as happens when all three are sown together in a mixed pasture. Further, there was an opportunity to "autumn save" some of these paddocks for winter grazing.

The clover is necessary to improve soil fertility, but most protein comes from grass species grazed judiciously and to a predetermined plan to take advantage of the higher protein content of the short younger growth for weaners, and the lesser but adequate protein in the more matured growth for older sheep.

Some figures of M. H. Walker taken during three Shannon Vale winters are of interest. Excluding the vast differences in residual feed on improved and natural pastures, improved pastures produced a daily growth of 5 to 7 lb. of dry matter per acre. Daily production of native pastures was negligible.

A production of 5 to 7 lb. dry matter per acre per day may seem small, but it is sufficient to maintain almost seven Merino wethers throughout the winters.

New work

To carry Cotsell's work a phase further, new work is in progress.

The studies of the genetic effect of breeding for high and low fleece weights at Trangie Agricultural Research Station are being duplicated under the high rainfall conditions at Shannon Vale. The ewes and their progeny are run at two and six per acre stocking rates and are being grazed under Cotsell's strategic system.

The smaller sheep is the progeny of ewes grazed at six per acre, and the larger sheep is the progeny of ewes grazed at two per acre. Both are less than twelve months old.

In other trials wethers are run at four eight and twelve per acre with superphosphate at ½, 1½ and 3 cwt. per acre. Strategic grazing with these dry sheep is being compared with set stocking at the same stocking rates and superphosphate levels. One set stocked section is receiving no superphosphate at all to see how long the bank of phosphate that has been built up in the paddocks will last. Wool production and body weights are measured. As each of these groups has its own little "farm" costs and returns are being studied.

A demonstration block of four paddocks totalling 40 acres is running 400 wethers.

For many years Cotsell's work was greeted with apathy and even some open hostility. Today, heavy stocking combined with better pasture management is one of the most discussed approaches to higher profits in sheep raising. ●

Blue Pith in Oranges

A blue colour in the pith or albedo of orange peel has been the subject of many inquiries to the Department of Agriculture recently.

This blue colour often develops in oranges that have been on the trees too long and are over-mature.

At first sight, the albedo appears to be infected by blue mould, but this is not so.

The blue colour is not caused by any fungus disease nor is it the result of sprays or any other cultural treatment.

Fruit affected in this way is quite wholesome to eat.

The blue colour, which is mostly quite pale, is found most commonly in the rind near the stem end of the fruit.

It is only noticed when the fruit is peeled, not when oranges are cut in half for juice extraction.

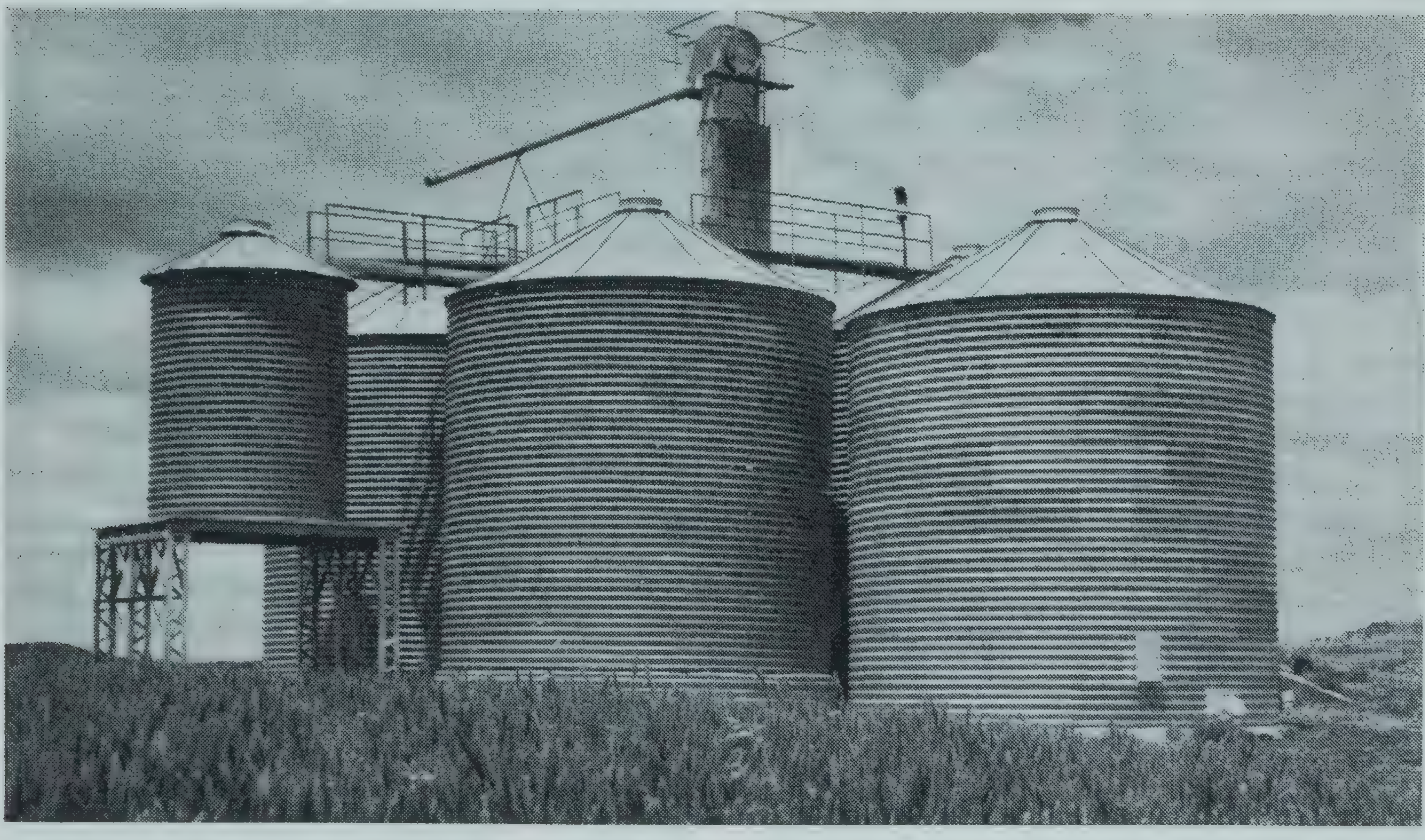
A similar condition has been reported from the U.S.A. as occurring in navels, grapefruit and in some tangleo varieties.

It is thought to be associated with a suspected virus disease called 'Stubborn', that does not appear to have reached Australia so far.

Blue albedo has not been observed in any fruits other than Valencia oranges in N.S.W. and only on this variety when fruit is over-mature. ●

FEATURES OF THE 1964-5 WHEAT SEASON

C. Walkden-Brown



Growers this season increased the on-farm storage capacity with a variety of temporary and permanent storage facilities, thus assisting in handling the record yields.

Wheat production in New South Wales during 1964-5 soared to an all-time record. The final official forecast of the Department of Agriculture, issued early in December, was for a total production of 160,00,000 bushels of grain. This figure, if realised, would be 38,000,000 bushels more than the previous record production of 1963-4, and 93,000,000 bushels more than the average annual production for the ten-year period 1954-5 to 1963-4.

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Latest information suggests that the actual harvest may not quite reach the estimate, but would be about 155,000,000 bushels. Of the New South Wales production last season, a total of about 145,000,000 bushels is expected to be delivered to the Australian Wheat Board (in New South Wales and Victoria) as either F.A.Q., premium, or off-grade wheat, mostly in bulk. In addition to this quantity, some 10,000,000 bushels will be retained on farms for seed and feed. Final production figures will not be known until provided by the Commonwealth Statistician late this year.

Acreage and production were greatest in the Southern Division, where about 60,500,000 bushels were harvested from about 2,330,000 acres sown for grain. In the Northern Division about 52,200,000 bushels were harvested from 1,590,000 acres sown for grain. In the Central Division about 47,300,000 bushels were gathered from a grain area of 1,880,000 acres. Average annual production for the previous ten years 1954-5 to 1963-4 was only 25,802,000 bushels from 1,316,000 acres in the Southern Division, 19,146,000 bushels from 1,033,000 acres in the Northern Division, and 22,076,000 bushels from 1,204,000 acres in the Central Division.

Yield per harvested acre over the whole State in 1964-5 was estimated to be 27.6 bushels per acre—almost three bushels per acre better than the previous record production per acre, in 1963-4, and over eight bushels per acre better than the average acre yield of 18.9 bushels over the ten-year period 1954-5 to 1963-4. Highest production on a per acre basis in 1964-5 was estimated to be in the Northern Division (32.8 bushels per acre compared with the average of 18.5 bushels over the previous ten-year period); in the Southern Division average yield was about 26 bushels per acre compared with the average of 19.6 bushels over the previous ten-year period; and in the Central Division 1964-5 average yield was 25.2 bushels per acre compared with the average of 18.3 bushels over the previous ten-year period.

Quality

Unusually fine weather over the harvesting period, associated with decreased likelihood of insect damage, resulted in a wheat grain moisture content considerably lower than the previous season, and lower than for some years past. At the same time, the wheat grain generally was well filled, of higher than usual bushel weight, and higher than the previous season, which itself was a good year.

Although of good physical quality, the wheat sample from some areas was not as attractive as is desirable, because of the presence of hard and soft grain in the one sample. In some deliveries there was more cracked and pinched grain than desirable—possibly attributable to the dry harvest weather and frost or root rot damage in some areas. In some cases, no doubt, excessive speed of harvesting or incomplete adjustment of harvesting machines contributed to grain damage.

Protein content of the grain was in general a little lower than in the previous year—an understandable occurrence in view of the high yields per acre.

Reasons for huge yields

A number of factors combined to produce this record crop in 1964-5.

One of the main factors was that the total area estimated to have been sown was a record 6,000,000 acres for all purposes—giving a harvested area of 5,800,000 acres for grain. Previous best acreage for grain was back in 1930-31, when 5,135,000 acres was sown for this purpose. In 1964-5 a greatly increased area of wheat grown under irrigation was harvested—probably 150,000 acres, compared with less than 100,000 acres in the previous year.

Climate played a major part in the record harvest. Seasonal conditions were favourable over all of the wheat belt throughout the growing season, following good pre-sowing rains. Almost without exception, conditions for germination and early growth were excellent. Although some areas experienced dry spells in August and November, subsequent rains ensured grain filling.

Most notable feature of the season was the fact that weather conditions during the whole of the harvesting period remained almost ideal; the crop year just finished will long be remembered as outstanding in this regard. Total rainfall for the year 1964 was about normal over the wheat belt, but its seasonal incidence was more suited to plant growth than usual. Also, other seasonal factors such as temperature and absence of drying winds, were more conducive than usual to growth.

Wider use by growers of improved officially recommended varieties sown at the correct time according to their maturity played an important part. Main varieties which contributed in 1964 both by reason of large areas sown and higher yields per acre were Gamenya, Heron, Olympic and Falcon. Each of these varieties had in official tests earlier proved its ability significantly to outyield other varieties then in commercial production, within the appropriate recommending zones.

The new rust resistant variety Festiguay entered recommendations in 1964. Although the acreage sown in this first year was relatively small, it contributed to increased yields by virtue of its relative resistance to cold damage as well as rust. It can be sown early with relative safety, enabling growers to take advantage of early rains.

Mendos, released in 1964 as a rust resistant replacement for Mengavi, compared favourably with that variety in yield, and retained its rust resistance.

Wheat breeders are pressing on with their task of producing higher yielding disease resistant varieties of improved quality. Their work is unobtrusive, sincere, and often unacclaimed, yet, by their efforts a continuing valuable contribution is being made to wheat growers and the industry.

Much of the 1964 wheat crop, particualrly in Central and Southern New South Wales, was sown on land which had previously been spelled under a predominantly leguminous pasture phase. Use of legumes such as subterranean clover, barrel medic, and lucerne within the wheat growing rotation has resulted in a marked increase in both yield and quality in the following wheat crop.

In 1964, crop damage by frost was considerably less than usual. Although some crops were badly affected by winter and spring frost, good following seasonal conditions generally enabled a satisfactory recovery. If yield reduction through frost injury had reached the same degree in 1964 as it did in 1958 (estimated at 12 per cent reduction), total yield last year could have been reduced by almost 20,000,000 bushels.

Overall damage from stem rust was small in 1964. Because of the favourable season an epidemic might have been expected under normal conditions. However, the acceptance by growers in rust liable areas of the official recommendation that they sow several varieties possessing different kinds of resistance to rust, rather than put "all their eggs in one basket", helped to reduce stem rust infection.

Root rot diseases were more prevalent in 1964 than for many years, particularly in Central and Southern areas. They caused marked yield reductions in some crops; however, losses were not as great as expected early, because of good finishing conditions.

Loose smut and Septoria diseases were also very prevalent, but did not appear to reduce total yields very much. Cereal yellow dwarf and flag smut affected crops in varying degrees, but incidence was mostly of a minor nature.

Another factor contributing to last year's record production was the marked increase in fertilizer usage by wheat growers. As a result of earlier research findings, superphosphate was applied on many wheat paddocks that were not previously fertilized, and at greater rates in regions which were accepted as being low in soil phosphorus. Nitrogenous fertilizers were used on many wheat crops for the first time—in association with superphosphate; but total use of nitrogen for this purpose was small compared with superphosphate used on wheat.

Use by wheat growers of modern machinery suited to large-scale farming, particularly sowing and harvesting, enabled

important operations to be efficiently performed at the right time. This has contributed in no small measure to the high wheat grain production which has been a feature of recent years.

Co-operation the keynote

Co-operation between wheat growers and handling, marketing and rail transport authorities during the 1964-5 harvest was the keynote of the success of this major operation, which was greatly aided by the unusually favourable harvesting weather. Growers built more on-farm storage facilities, either permanent or of an emergency nature. They also contributed materials and much labour for receival of wheat into temporary storages set up by the Grain Elevators Board at receival points. The New South Wales Grain Elevators Board handled bulk receivals with commendable efficiency despite the fact that at mid-January 1965 the Grain Elevators Board alone had received more wheat than the total delivery for the State in any previous season.

Handling of the crop was greatly aided by fast rail movement and by excellent overseas sales made by the Australian Wheat Board. This enabled shipping from the terminal elevators to proceed with a minimum of interruption.

Looking ahead

We are now at the start of a new wheat crop season. A challenging thought is that progress of scientific knowledge and its application by growers will undoubtedly result in even bigger harvests in time to come. ●

Inaccurate Soil Tests Could Cause Heavy Losses

Treatment of soil to correct "deficiencies" indicated by inaccurate soil tests could involve farmers in heavy losses.

Soil tests could not replace the experience of agricultural experts in the field, though tests were useful in supplementing their experience.

In the past 10 years several organisations have tried to help farmers by providing soil and plant tests.

Many of these tests have been soundly based, but misleading information has resulted from unsound tests.

Citrus

During a recent citrus survey conducted by the Department's Chemistry Branch, several growers asked "how much lime would be needed to correct a soil pH of between 3.5 and 4.0?"

Officers of the chemistry branch took soil samples to verify the soil pH before they made a recommendation.

Their tests showed that the soil had a pH of 6.0—well above the range of 3.5 to 4.0 indicated by a commercial test.

Had lime recommendations been based on the lower pH figures, considerable risks would have been involved.

Copper

In another case an application of copper had been recommended by a fertilizer company to combat dieback on apple trees.

Subsequent investigations showed that this dieback had been caused by poor drainage and an unsatisfactory rootstock.

In yet another case, a firm had recommended copper applications to soils where toxaemic jaundice was prevalent in sheep.

Under the prevailing conditions, applications of copper could make sheep more susceptible to the disease. ●

Livestock Health Notes

J. S. HEALEY

PREGNANCY TOXAEMIA

PREGNANCY TOXAEMIA is a perennial problem in many parts of the State as lambing approaches. Long recognised, it is commonly called "twin lamb disease". Despite the latter title, pregnancy toxaemia can occur in sheep bearing a single lamb, though mostly it is ewes carrying twins that are affected.

Two broad types of the disease are recognised. One occurs in sheep that have experienced prolonged and progressively more severe under-nourishment during the last six weeks of pregnancy. The second type occurs in well fed ewes that have been subjected to virtually a complete fast and to some severe stress. These conditions can be caused by a long rail journey, severe weather, or an outbreak of disease such as footrot.

In recent years much progress has been made in understanding what has been proved to be a complicated subject. In a ewe with pregnancy toxaemia there is a chain reaction leading to the malfunctioning of several important glands. There is a reduction in blood sugar level so that the demand for this substance by the lamb or lambs exceeds the maternal supply. It is on this account that the dosing of affected ewes with glycerine often leads to recovery. The glycerine is rapidly converted in the animal's body to sugar.

Glycerine is administered to affected animals twice daily. Treatment needs to be commenced before symptoms have become advanced, and to prevent a possible relapse is best continued for several days after apparent recovery. The type of pregnancy toxaemia that results from sudden stress responds better to glycerine than does the type induced by lengthy undernutrition.

An important consideration is that sheep fat at mating time or in early pregnancy are more susceptible to the effects of feed shortage than those in normal condition at this period. Unfortunately very often when an outbreak of pregnancy toxaemia occurs, deaths from this disease do not represent the total losses. The conditions that bring on pregnancy toxaemia so often also cause the birth of weak lambs, many of which fail to survive.

COCCIDIOSIS AS CAUSE OF SHEEP SCOURS

IF SHEEP at this time of the year show a black scour and rapid loss of condition, infestation with the black scour worm is possibly responsible. However, another cause could be coccidiosis.

Coccidiosis is caused by infection with a microscopic parasite that belongs to a group of organisms called protozoa. Lambs and weaners are the most susceptible, but outbreaks can occur in adult sheep. Coccidiosis is a disease against which sheep can build up immunity if exposed to low levels of infection over a long period. The class of grown sheep usually affected are therefore those newly introduced.

Coccidiosis is most likely to occur in the winter time and when the rate of stocking is high, feed is poor and wet weather prevails. The symptoms are a dark scour and severe straining. The droppings are very watery and occasionally contain blood. Affected sheep lose condition rapidly. Although most cases of the disease recover, mortality can be quite significant, particularly when young lambs are the sufferers. Of course, coccidiosis and heavy worm infestation can occur at the same time. Naturally when this happens losses are likely to be much heavier than if only one malady is present.

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Fortunately, unless the sheep are badly affected, most will recover without treatment. For those bad enough to need dosing, some of the sulphonamide drugs are the answer. The most widely used is sulphadimidine. Draft the sheep needing treatment into a hospital paddock and turn the remainder of the mob into a larger area. It is all the better if this can be done early in the outbreak.

Coccidiosis is spread by means of what are called occysts which are passed in the droppings of infected sheep. Occysts are extremely hardy and can remain alive in pastures for many months.

NEW LIGHT ON WORM HABITS

The painstaking efforts of research scientists are gradually providing valuable information on the role of rotational grazing and adequate nutrition in the control of sheep worms. The use of rotational grazing for worm control has in the past been based on the concept that during the periods paddocks are unstocked, there is considerable destruction of worm larvae.

Detailed research into the length of time that larvae will survive on pastures has only recently been undertaken and as yet is far from complete. However this work has so far indicated that when temperatures are moderate and there is high rainfall, the period of survival can be much longer than was formerly thought. In fact it can run into many months. Thus when weather conditions are favourable to the spread of worms, rotational grazing alone cannot be relied upon to give control. This limitation does not, of course, condemn rotational grazing as a husbandry practice. During the hot summer months, for example, the spelling of a paddock for a month would greatly reduce the number of worm larvae contaminating pastures.

The part played by nutrition in enabling sheep to resist worms has also come in for critical examination. It has long been known that good feed bolsters the resistance of sheep to the effects of a worm burden. Research has now revealed another way in which good nutrition runs counter to worm infestation. It has been shown in the case of some worm species that fewer parasites became established in well nourished sheep than in poorly fed animals.

These findings point the need for a planned flexible drenching programme, to be integrated with husbandry practices aimed at worm control.

LICE MAY INFEST CATTLE

Most insects tend to flourish during the warmer months of the year, but not so lice. Their numbers are greatest during the winter.

Lice which affect cattle are divided into two categories, sucking lice and biting lice. The former feed by piercing the animal's skin and drawing blood. Biting lice gnaw at the skin. Sucking lice usually affect cattle more seriously than biting lice. The particular louse which causes most trouble in grown beef cattle is called the short-nosed sucking louse. Another species known as the long-nosed cattle louse is most commonly seen on dairy stock, particularly young animals.

Lice breed on the skin of cattle and spread when infested stock come into direct contact with other cattle. Lice cannot survive once they leave an animal. This, of course, is an advantage from the point of view of control.

Small numbers of lice do not greatly worry cattle, but if present in large numbers, can cause loss in condition and reduced milk production. A feature of lice infestation is that individual cattle in poorer condition than the remainder of the herd, tend to be the more heavily infested animals.

Spraying cattle with any one of the organic phosphate insecticides will give good control. Total eradication of lice has been achieved by treating all cattle in a herd twice at an interval of 14 days. If eradication is being attempted it is important that the cattle be thoroughly wetted with the insecticide, not forgetting the somewhat longer hair of the head and the tail.

In the cattle tick areas of northern New South Wales, stockowners have noted an improvement in the condition of cattle, after dipping for cattle tick has eliminated lice.

TAKE CARE IN GIVING DRUGS

THE IMPORTANCE of a careful study of the directions accompanying drugs is brought out by a case recently reported by the District Veterinary Officer, Newcastle. A poultry farmer had, quite wisely, been adding to the mash fed to his chickens a drug to protect against coccidiosis. He later changed to a different drug having the same effect. Without checking the directions he assumed that the new material should be added at the same rate as the previous one. The result was that the new drug was fed at four times the recommended strength, and a number of the chickens died from poisoning. •

Tractors Feel the Cold

Tractor operators having difficulty starting their tractors on cold mornings are offered the following advice.

Where possible the tractor should be stored in the warmest part of the shed, and not be left exposed to cold winds.

Some farmers find it advantageous to cover the engine at night. This helps insulate it from cold and to retain some heat until morning.

Before attempting to start the engine, crank it a few times by hand, with the ignition off. This loosens the moving parts and lessens the load on the battery and self starter.

The engine should be warmed up quickly after starting.

The battery should be kept fully charged. If necessary remove it at night and recharge it with a "trickle" charger.

Use a lighter grade of lubricating oil in winter. The proper grade is recommended by the major oil companies or the tractor manufacturer.

Engine oils are thicker at lower temperatures; this puts a greater strain on the starting mechanism.

Use only the highest grade of fuel for wintertime operation.

Fill the fuel tank at the end of each day's work. This lessens the accumulation of condensed moisture from air inside the tank.

Lubricate the tractor at the end of the day's work. Grease will force moisture out of the bearings easier when they are warm. Keep sediment bowls clean by emptying them regularly.

Remove the crankcase drain plug frequently to check for accumulation of condensed moisture in the crankcase. If much is found, drain off the old and refill when the tractor is warm.

Farmers in areas where anti-freeze solutions are necessary in the radiator and in the tyres should use only the highest grade antifreeze solution available.

Never put hot water into a cold engine or cold water into a hot engine, as either could crack the cylinder water jacket. •

Avocado grove in a sheltered site near Mullumbimby; banana plantation on left is worked in conjunction with the avocadoes.

AVOCADO GROWING on the North Coast

LIMITED COMMERCIAL GROWING of avocadoes on the north coast of New South Wales offers a sound long term investment if certain precautions are taken and plantings made only on carefully selected sites.

Avocadoes are extremely susceptible to the root rot fungus *Phytophthora cinnamomi*, which thrives in poorly drained soils. No known avocado rootstocks show worthwhile resistance to the disease and little can be done to protect trees once planted in areas subject to infection.

For this reason both surface and subsoil drainage must be excellent. Sloping ground with a porous surface structure may be rendered unsuitable by clay bands or hard pans preventing the free flow of water through the soil. The type of plants growing on the land often provides a good indication of localised soakages and high water tables.

Although a slight slope is advantageous, hillsides that do not permit the use of vehicles should be avoided. Steep areas make harvesting and other cultural operations difficult and are susceptible to erosion.

The area should be as frost free as possible and sheltered from strong winds. Extremes of weather affect fruit setting and tree growth, whilst strong winds cause fruit blemish.

Land preparation

Land preparation will vary considerably, according to the location, but deep ripping is always an advantage. Under ideal conditions, the site may be completely ripped and cultivated. Alternatively, ripping and

Previously deep ripped and cultivated, land has been pegged out and avocado seed sown direct. Seedlings will be grafted where they are, to eliminate setbacks at transplanting. Note natural windbreak at right.

F. C. Chalker

cultivation may be carried out only along the tree rows, leaving strips of unbroken grassland running across the slope. In other cases, the rows may be ripped but not cultivated, and the trees planted in individually prepared areas of 6 to 8 feet diameter. The growth of inter-row crops for the first two to three years can also influence the extent of soil preparation.

Ripping will vary with the bulldozer used and the site. Ideally, each row should be ripped to a depth of 20 to 26 inches with rippers set 18 to 24 inches apart, covering an overall width of 6 feet.

When multiple rippers are used on land covered by a dense matt of grass such as kikuyu, the closer spacing of rippers may not be practical. However, in friable soils, with deeply set rippers, spacings of up to 30 inches give adequate shattering.

Some tractors may use a single ripper set to a depth of 24 to 30 inches, traversing each row two or three times, whilst others may use four or five rippers set 18 inches apart to a depth of 18 inches.

Consideration should be given at this stage to the provision of adequate roadways and surface drains.

Planting distances

It is suggested that planting distances and orchard design be discussed with your local fruit officer as many things must be taken into account. Trees of each variety vary in size, shape, cropping habit and fruit maturity.

They eventually grow to a large size, and a minimum permanent spacing of 35 feet is required. When planted closer than this, trees eventually touch and limbs die out, leaving only an overhead canopy of foliage

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Avocadoes are prone to attack by the root rot fungus *Phytopththora cinnamomi* when grown in poorly drained areas; this tree died soon after reaching bearing age.

Steep hillsides are susceptible to erosion, make harvesting difficult; upright nature of this tree accentuates the problem.

some 30 feet above the ground. Thus, the fruiting area is greatly reduced and harvesting made difficult.

As only 35 trees per acre can be established at this spacing, double planting is recommended to increase returns and land usage in the young orchard.

In this way, row spacings are reduced to 30 feet and trees planted at intervals of 18 to 20 feet in the row. In 10 or 12 years time, before overcrowding occurs, each alternate tree in the row would be removed to give a final planting distance of 30 feet by 40 feet.

Such a factor as the angle at which vehicles can traverse steeper slopes may dictate the direction of rows, but all things being equal they should run north and south to allow better penetration of sunlight.

Planting

As seedling avocado trees are very irregular in cropping habit, fruit quality and tree size, it is necessary to plant trees "worked" or grafted to a recommended variety.

A spread of harvesting and cultural operations can be achieved in commercial orchards by growing a range of varieties. Some of these are: Zutano, Rincon, Fuerte, Nabal, Hazard, Sharwil, Hass, and Edranol.

The harvesting periods for these vary from April-May (for the early varieties such as Zutano, Rincon and Fuerte) to September-November for the later varieties such as Hass.

It is becoming increasingly popular to purchase grafted trees in tins or tubes rather than bare root or open earth trees. Trees raised in nursery beds are consigned to the grower with no soil adhering to the roots and generally with the leaf area greatly reduced.

Both types of tree require careful planting. While holes should be dug large enough to take the root system comfortably, holes too deep are unnecessary and undesirable.

Fruit of the Hass avocado is rough skinned, turns purple when ripe; an important late maturing variety, it is a heavy cropper but tends to be an upright grower.

Potted trees can usually be planted without disturbing the root system. However, where the trees have remained in the tubes too long and become root bound, a gentle loosening and straightening of the roots is desired. If excessively pot bound, and severe root disturbance is necessary, the leaf area must be correspondingly reduced by removing some leaves or small twigs. With a damaged root system, the young tree cannot take up its normal amount of water. The removal of leaves reduces the quantity of water lost by the plant and so lessens the risk of the whole plant wilting.

With open earth trees, roots should be straightened and spread, with the strongest root and limb growth facing to the south or southwest. This ensures that the tree will be strengthened against prevailing winds and well developed on the shaded and backward quarter.

After almost filling the hole with fine top soil, three to four gallons of water is used to settle the soil firmly around the roots. Periodical watering may be necessary until the trees are well established. Mulching around the trees is important as it reduces the water losses and the effects of sunburn.

As avocadoes are evergreen, they can be planted at almost any time and, in fact, planting time is often determined by the availability of grafted trees. Preference is given to late winter plantings when cool weather allows good establishment before the advent of hot weather.

Time of planting, type of tree, weather conditions and natural protection available will determine whether shelter is required after planting. If planted out in hot weather, trees should be provided with hessian protection. Generally speaking it is best to shelter young trees, as a little extra care reduces the loss of young trees and helps them to develop better.

Pruning

Once established, little pruning is required as avocado trees generally shape themselves. Limbs causing overcrowding or poor shape may be pinched back, and shoots arising from below the union should be removed.

Harvesting and insect control can be difficult on very upright growing trees. For this reason some varieties, including Hass, can be heavily topped at three to four years of age in an attempt to develop several large, spreading limbs rather than one central upright trunk. Topping, to be successful, must be severe, and the cut made just above several well developed spreading limbs. If this is not done, strong upright growth will rapidly develop from below the cut and the

Well-grown four-year-old Hass avocado tree showing upright tendency; popular variety Fuerte is more spreading in nature.

Avocadoes planted between banana stools. Bananas provide excellent shelter for young plants; will be removed as trees get bigger.

Avocado groves are well suited to permanent sod culture—lower limbs shade out weed growth; sod should be kept well mown.

tree quickly continue its upright habit of growth.

Avocado trees have a natural tendency for the lower limbs to grow towards the ground, and attempts to "skirt" them usually only effect temporary relief. When trees are three to four years old, wiring or propping of lower limbs may overcome this problem by developing a strong and rigid lower framework. Lower limbs should only be cut sparingly.

Cultivation

Regardless of the extent of initial land preparation, it is important that weed growth be completely eliminated within 3 to 4 feet around young trees. Every effort should be made to ensure that young trees receive the maximum care, and any competition with weeds at this stage can seriously extend the period till cropping.

Fertilizer

Young trees benefit from light dressings of a complete fertilizer or from dressings of animal manure. As a guide, 1 lb. of a fertilizer with an NPK ratio of about 10:6:10 could be applied to a one-year-old tree in three applications—one in spring, one in summer and the other in autumn. A two-year-old tree could have 2 lb. and a three-year-old 3 lb. As the tree increases in age and starts to bear, the ratio of nitrogen should be increased. The fertilizer should be put on when the soil is wet and watered in by rains or irrigation. This prevents burning of the roots. The fertilizer must be broadcast widely around the tree and not close to the trunk.

Avocado trees established and cared for as discussed in this article will begin bearing when about three years old, and commercially at five or six years of age. ●

RESEARCH SECTION

New Detergents for Cleaning Milking Machines

IMPROVED DETERGENTS for cleaning milking machines have been developed at Hawkesbury Agricultural College. The original Ruakura detergent formula published by Dr. W. G. Whittlestone in 1952 allowed a big advance in milking machine cleaning. However, excessive foaming of detergents based on the Ruakura formula has become a problem following the widespread use of recirculation cleaning systems.

A. Twomey, Dairy Research Officer. has formulated and tested four detergents that he considered would have the good cleaning qualities of the Ruakura formula but would be less likely to produce excessive foam. Two of them are as effective as the Ruakura formula in removing milk deposits, and produce much less foam. The compositions of these two detergents are shown in the table.

Composition of the new detergents developed for cleaning of milking machines

Component	Proportion (% w/w) Formula 1	Formula 2
Sodium carbonate	56	52
Sodium silicate ($Na_2SiO_3.5H_2O$)	30	30
Sodium hexametaphosphate	10	10
Octyl phenol ethylene oxide condensate*	2	4
Alkyl aryl sulphonate	2	4

* Containing 5 ethylene oxide moles.

Clarence Valley Pastures Respond To Superphosphate

YIELDS of Ladino white clover and *Lotononis bainesii* pastures in the mid-Clarence Valley were increased about four-fold by applying 2 cwt. of superphosphate per acre in 1964. Yield increases were even greater with 4 cwt. of superphosphate, and in some trials further increases were obtained with 6 cwt. per acre. The table shows the yields from two trials on a granite soil at Cinnabar.

Analyses of plant material provided further evidence that the phosphorus level of most of the soils is extremely low. The phosphorus content of the plants in the treatments without superphosphate was below 0.1 per cent in four of the five trials. A plant phosphorus content of 0.1 per cent indicates that the soil is deficient in phosphorus, and that plant growth will be limited. Applications of 2 cwt. of superphosphate per acre raised the plant phosphorus content to above the 0.1 per cent level, and further increases occurred at the 4 and 6 cwt. superphosphate rates.

The trials will be continued as part of a project financed by the Australian Cattle and Beef Research Committee. The aims are to determine: The pasture response to different rates of superphosphate; the build-up of soil phosphorus with repeated applications, and the level of soil phosphorus needed to maintain satisfactory pasture production on each soil type. The phosphorus requirements of these major soil types will be linked with soil tests.

J. Bradley of the Chemistry Branch and D. R. Brooks of the Agricultural Research Station, Grafton, were responsible f the 1964 trials. This ye E. Havilah is the Grafton agro omist working with Mr. Bradl on the project.

The trend of the 1964 tria suggests that 3 cwt. of supe phosphate per acre is necessa for pasture establishment in th area. Three cwt. has also be recommended as the minimu rate for tropical legume esta lishment in south-east Queen land.*

* Douglas, N. J. and Luck, P. (1964)—"Farmers Guide to Tro cal Pastures in S.E. Queenslan *Queensland Agricultural Journ* **90** (10): 583-94.

Yield of total pasture and yield of legume (lb. dry matter per acre) fro four superphosphate treatments on Ladino clover and *Lotononis baine* plots at Cinnabar. Sown 21-2-64 and harvested 9 & 10-6-64.

Plot		Superphosphate rate (cwt. per acr 0	2	4	6
Ladino	Legume	9	84	1280	1167
	Total pasture	386	1751	2229	2292
Lotononis	Legume	6	750	1120	1283
	Total pasture	399	1589	2093	2198

Mixed Ripe Bananas

THE TERM "mixed ripe" is used in the banana industry to describe a hand, bunch, case or carton of bananas containing both green and ripening fruit. The ripening is indicated by a change of skin colour from green to, or towards, yellow. Mixed ripe fruit brings lower prices, and is more difficult to sell than fruit of uniform ripeness. The aim of the grower is to have well filled fruit reach the market in hard green condition. This could probably be achieved if the factors that affect ripening were better understood, or if the onset of ripening could be accurately predicted.

It is known that both maturity at harvest, and the post-harvest environment are concerned in the mixed ripe problem. At the Tropical Fruit Research Station, Alstonville, research officers R. J. Rose and D. W. Turner are attempting to define the effects of individual factors on ripening. The importance of temperature and of physical aspects of the fruit, includi weight, length and circumfe ence, in the initiation of ripe ing are being studied.

Early experiments show that both length and weight the fruit were related to the ti taken to ripen. A smaller corr lation was found betwe circumference and the time ripen. Some information h also been obtained about t variation within and betwe bunches.

Because the proportion

mixed ripe fruit is highest from January to April an experiment is in progress to examine ripening times of fruit harvested in this period. Ripening behaviour has been recorded for four bunch emergence times (June, September, November and December) and different degrees of fullness of fruit (half, three-quarters, full and over-full).

More comprehensive, and in some respects more accurate, ripening studies will be possible now that cool rooms and ripening rooms have been built at the Station.

Another approach to the problem of mixed ripe bananas is to seek methods of predicting time to ripen by chemical analysis of the fruit. Fruit Research Officer, T. Trochoulias, has tested a number of indicators. Some of them are no improvement over inspection of the colour of the fruit skin, but others show promise of being more accurate. For example, a colourimetric test has been developed for measuring leucoanthocyanidin, and applied to bananas at various stages of maturity as determined by colour and respiration. It has been found that there is an initial sharp drop in leucoanthocyanidin content at the hard green stage, another drop at the onset of ripening, and then the level remains constant. This and other possible tests for stage of maturity are being studied further.

These investigations are being conducted for the Banana Research Advisory Committee and are supported with funds contributed by the Commonwealth Government and the Australian Banana Growers' Council. ●

Classifying Wheat Varieties as Hard or Soft

In its final report the Advisory Committee on Wheat Production and Marketing* recommended that only hard wheats be grown in some areas of New South Wales and only soft wheats in others. If this recommendation is to be adopted it will be necessary to classify varieties as hard or soft. Sometimes, looking at a sample of grain is sufficient to classify a variety, but a graded scale of hardness based on tests would be much more useful.

When milled, hard wheats give a granular flour that runs like sand, while soft wheats produce a very fine flour that clings together in lumps. This knowledge has been used to design a simple test for hardness. In the test, a measured amount of wheat is ground and sieved on a very fine gauze (200 mesh), and the amount coming through the sieve is weighed. This weight is recorded as a percentage of the original sample and called the particle size index, or p.s.i. The softer the wheat the finer the flour and the higher the particle size index.

K. J. Symes of the Agricultural Research Institute, Wagga Wagga, has classified wheat varieties on particle size index using values obtained over five years. The table lists the most common varieties according to particle size index.

It has become customary to suggest that Australian hard wheats are not really hard by referring to them as "semi-hard", but Mr. Symes points out that the famous Canadian hard wheats, Marquis and Thatcher, have particle size indices in the range 15 to 18.

* N.S.W. Advisory Committee on Wheat Production and Marketing, *Final Report,* Nov. 1963.

Common wheat varieties classified by particle size index

p.s.i. (per cent.)	Varieties
Hard Wheats	
10.0 to 10.9	Baringa.
11.0 to 11.9	Curlew, Charter.
12.0 to 12.9	Festival, Saga, Falcon, Claymore, Festiguay.
13.0 to 13.9	Pusa 4.
14.0 to 14.9	Gabo, Gular.
15.0 to 15.9	Eureka 2, Celebration, Dundee, Kendee.
16.0 to 16.9	Dirk.
17.0 to 17.9	Koala, Winter Minflor, Winglen, Sabre.
18.0 to 18.9	Koda, Windebri, Spica.
Soft Wheats	
22.0 to 22.9	Mengavi.
23.0 to 23.9	Gamenya, Bobin, Moora.
24.0 to 24.9	
25.0 to 25.9	Bordan, Javelin 48, Magnet.
26.0 to 26.9	
27.0 to 27.9	Glenwari, Bencubbin.
28.0 to 28.9	Pinnacle, Olympic.
29.0 to 29.9	Ford, Heron.
30.0 to 30.9	Insignia, Insignia 49, Sherpa.
31.0 to 31.9	Beacon, Quadrat.

Sown Pastures in Strips

AT THE Agricultural Research Station, Grafton, Agronomist G. Wilson is co-operating in the development of a new sod-seeder. The new implement will have many possible applications including testing of a theory about the introduction of improved pasture species on coastal beef properties.

If the first improved pasture on a beef property is sown as a solid block, the property owner has to spend capital on subdivision, or the cattle will concentrate on the improved area and neglect native pasture areas. An alternative to sowing the improved species in one block would be to spread the same amount of seed and fertilizer over a large part of the property as widely spaced sod-seeded strips. Then the cattle would range over the whole area, making better use of the higher quality species and assisting their spread.

The idea of sowing widely spaced strips over a large area would not be practical with existing sod-seeders for some pasture species. The sod-seeder now being developed is designed to place the seed precisely in a favourable seedbed and concentrate the superphosphate near the seed. The per acre rate of superphosphate applied would be low but the rate in the ro[w] could be equivalent to 6 cw[t]. Pastures sown in widely space[d] strips could be maintained b[y] spreading superphosphate fro[m] the air in later years.

Strip sowing would have mos[t] application to heavy seedin[g] species that are easily spread b[y] stock and natural means. But i[t] could also be applied to stoloniferous species. For example although *Lotononis baines[ii]* seeds heavily, the vegetativ[e] spread seems more importan[t] on the Upper Clarence and i[t] spreads best when the origina[l] plants are established unde[r] favourable conditions.

Book Review

THE PRINCIPLES OF AGRICULTURAL ENTOMOLOGY

C. A. Edwards and G. W. Heath, Chapman and Hall Ltd., London, 1964. XIV + 418 pp., 36 pl., 62 figs., refs. Price £4 Stg.

The reviewer is Mr. P. C. Hely, Chief Entomologist.

THE BOOK *The Principles of Agricultural Entomology* deals with just what the title says it does. The authors, Drs. Edwards and Heath, have combined their experiences well. They have throughout had in mind a clear objective of conveying to the reader how, when and why agricultural pests occur, develop and cause damage. Having given that background knowledge, they have added brief recommendations for specific control measures.

General principles are dealt with in chapters on structure and physiology, reproduction and classification; how pests cause damage and loss; ecological considerations resulting in increase in pest numbers; economics of pest control; pest assessment and forecasting; methods and principles of control; insecticides and application machinery, and insects and virus transmission.

Descriptions, bionomics and control of individual pests are dealt with in separate chapters covering slugs, snails, etc.; biting and sucking lice and fleas; thrips and bugs; sawflies and beetles; butterflies and moths, and flies. Finally, keys are given to the pests which may attack different groups of crops or products.

The authors have had experience in the scientific study of insects at Rothamsted, and close contact with practical farming in advisory work with the National Agricultural Advisory Service. They have drawn on their experiences and hav[e] welded them into a readable interesting and valuable handbook which should be on th[e] bookshelves of every agricultural extension officer and practising entomologist. It shoul[d] also be a good textbook fo[r] students in applied entomolog[y] and for progressive farmers.

Although the pests dealt wit[h] are those of U.K. agriculture this does not by any mean[s] detract from its value t[o] Australian agriculturists.

A few rather surprising statements occur, and one is interested to read, for example, tha[t] "adult moths are never pests" that "prohibition on the impor[t] of potatoes in the U.K. fro[m] Australia is aimed at preventin[g] the introduction of Colorad[o] potato beetle"; and that "'fer[n] leaf' is caused by the tomat[o] spotted wilt virus".

The book is well illustrate[d] with some very fine photographic plates.

The Stability of Vitamin A in Commercial Poultry Feeds

C. Humphris

SUMMARY

Six commercial poultry mashes, containing vitamin A stabilised in a gelatin base, were selected at random from production lines or manufacturers' stocks and stored for six months under farm and warehouse summer storage conditions. Vitamin A and carotene storage losses were determined by analysing samples taken at monthly intervals.

The mashes retained from 74 to 90 per cent of their initial vitamin A content, and from 16 to 40 per cent of their carotene content. These figures compare favourably with those reported from other stability investigations.

The vitamin A levels, initially and after storage, are compared with the manufacturers' claimed levels and with published recommendations regarding the vitamin A requirements of poultry.

The vitamin A molecule is highly unsaturated and is very sensitive to oxidative destruction; it is readily broken down by contact with air and minerals, as well as by light and heat. Since vitamin A is essential in animal nutrition its stability in feed mixtures is important and has been the subject of considerable investigation.

Fish oils were the main source of vitamin A for many years. Holmes et al (1936) reported that cod liver oil stored in partly-filled bottles had lost all vitamin A activity within six weeks: stability was improved to some degree by the addition of antioxidants. Fraps and Kemmerer (1937) showed that feed mixtures containing fish oils lost up to 100 per cent of their vitamin A content when stored for four weeks at 28°C. Bethke et al (1939) reported increased rates of breakdown when meat scraps were included in the feed mixture. They also demonstrated that stability was not increased by the addition of antioxidants.

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Carotene also has poor stability. Thompson (1950) found that alfalfa (lucerne) meal retained only 54 per cent of its original carotene content after 16 weeks at 25°C. Wall and Kelley (1951) showed that carotene, when added to chicken mash at 3,000 international units (i.u.) per lb., lost 50 per cent of its potency in less than three months.

Wall and Kelley (1951), studying factors affecting the stability of vitamin A and carotene in dry mixtures, reported that temperature was the most important variable, and that in most cases it outweighed all other factors combined. Stability was stated to be inversely proportional to temperature. A comparison of rate of breakdown of vitamin A added in the form of fish liver oil to feed mixtures stored at 42°F. and at room temperatures (66-96°F.) showed that the rate was twice as high at the higher temperature (Reid, Daugherty and Couch, 1955).

When synthetic vitamin A became available in dry form, it was stabilised before mixing with other feed constituents, either by the addition of antioxidants or by dispersion in a protective medium; wax, hard fat, gelatin and ethyl cellulose were the most commonly used media. Experiments to determine the biological availability of vitamin A in these forms showed that some stabilising media prevented complete utilisation of the vitamin by the animal. Olsen et al (1955) studied the utilisation by chicks of the vitamin A in several commercial dry-form supplements and found the gelatin-coated preparations to be superior in this respect to those in which the vitamin was coated with wax or fat or was adsorbed on to vegetable protein.

Brubacher et al (1962), using a tracer technique to determine absorption efficiency of gelatin-stabilised vitamin A in chickens, showed that at least 97 per cent of the vitamin A intake is absorbed, thus providing evidence that this stabilised form is absorbed even more completely than the unstabilised oily preparations.

Many stabilised dry vitamin A preparations now consist of antioxidant-protected vitamin A palmitate finely dispersed throughout a gelatin-type base. In this form the vitamin is readily absorbed and comparatively stable. Bauernfeind (1960) showed that a concentrate of this type was two to eight times as stable as fish oil stored under similar conditions. In five comparative tests, in which the stabilised supplement and a fish oil were individually mixed into complete feeds and stored for sixteen weeks at 75°F., the average retention of the stabilised supplement was reported to be 90 per cent, whereas the feed containing fish oil retained only 28 per cent of the original vitamin A content.

Most of the studies quoted were carried out under controlled conditions, with specially compounded feeds. The work described in this paper was undertaken to test the rate of breakdown of vitamin A in some locally manufactured commercial feeds stored under normal summer conditions.

Method

One bag (approximately 120 lb.) each of chick starter mash and laying mash, was taken at random from the production line or from recently compounded stock of each of three manufacturers. The vitamin A concentrates used by each manufacturer were from different suppliers; all were of the gelatin encapsulated type.

The mashes were stored at the Seven Hills Poultry Research Station in a timber shed approximately 36 ft. square, partially open on the northern side. To protect them against dampness and vermin, the bags were stood on a timber platform and covered with a fine-mesh bird wire. The conditions of storage were considered equivalent to well-managed farm or warehouse conditions. A maximum-minimum thermometer on the platform was used to record the monthly temperature variations.

Samples for analysis were taken at the beginning of the experiment (October 1963) and at the end of the first, second, third and sixth months of storage. Samples were taken with a grain tryer inserted into the bag at a number of positions.

The samples were placed in polythene containers with air-tight screw-top lids, and stored at 3°C. pending analysis, which was carried out within ten days. Each sample weighed about 3 lb.

The analytical methods for vitamin A and carotene were based on those of the A.O.A.C. (1960), with certain adaptations and modifications found to give highest recoveries in tests before the commencement of the experiment. Analyses were performed in duplicate, a known amount of U.S.P. Standard Vitamin A being added to one flask to check recovery. Acceptable recoveries ranged between 90 and 96 per cent. When recovery fell below 90 per cent the analyses were repeated.

Results and discussion

The vitamin A content of the mashes after six months varied from 74 to 90 per cent of the original level. After thre months, the more likely storag period and a more suitable basi for comparison with other work the mashes retained from 85 t 93 per cent of their origina vitamin A content (table an figure). Carotene content varie from 50 to 72 per cent of th original level after three month and from 16 to 40 per cen after six months.

Three of the samples (S1, L and S3) had vitamin A content above those claimed by th manufacturers, even after thre months storage. The initia levels in mashes S2 and L approximated those claimed fo them, but levels had dropped b 14 to 15 per cent after thre months. Their carotene conten was just sufficient to make u the total vitamin A activity t 3,500 i.u./lb. The initial vita min A content of sample L reached the specified figure onl by including carotene.

Recommendations regardin the amount of vitamin A to b added to poultry feeds var considerably. Some figure represent the minimum amour required for sustenance, other make adequate allowance fo stress factors. A generall accepted recommendatior which allows a 66 per cent mar gin of safety above minimur requirements, is 2,000 i.u./lt for chickens and 3,300 i.u./lt for laying birds, (Committee o Animal Nutrition, 1954). Th initial total vitamin A activit (including carotene) of a samples met these requirement and in only one case did it fa below them after three month storage at summer temperature

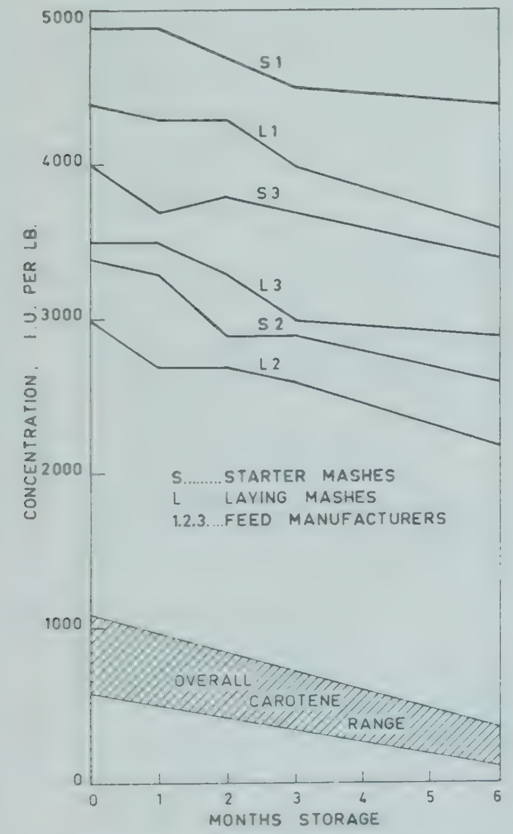
The results are similar t those of Bauernfeind (1960 who used antioxidant-protecte vitamin A dispersed in a gela tin-sugar-starch base (a typ

Vitamin A and carotene content of chick starter and laying mashes after specific periods of storage

Sample†	Nominal vit. A level	Vitamin A and carotene* remaining (international units per lb.) — Months of storage, and temperature ranges: 0	%	1 (88° — 48°F)	%	2 (91° — 54°F)	%	3 (103° — 55°F)	%	6 (97° — 50°F)	%
S 1	3600	4900	100	4900	100	4700	96	4500	92	4400	90
		800	*100*	*700*	*88*	*600*	*75*	*520*	*65*	*260*	*32*
S 2	3500	3400	100	3300	97	2900	85	2900	85	2600	77
		850	*100*	*730*	*86*	*550*	*65*	*470*	*55*	*140*	*16*
S 3	3500	4000	100	3700	93	3800	95	3700	93	3400	85
		700	*100*	*600*	*86*	*500*	*71*	*450*	*64*	*200*	*29*
L 1	4000	4400	100	4300	97	4300	97	4000	91	3600	82
		950	*100*	*850*	*89*	*760*	*80*	*680*	*72*	*380*	*40*
L 2	3500	3000	100	2700	90	2700	90	2600	87	2200	74
		600	*100*	*450*	*75*	*400*	*67*	*300*	*50*	*220*	*37*
L 3	3500	3500	100	3500	100	3300	94	3000	86	2900	83
		1100	*100*	*830*	*75*	*700*	*64*	*570*	*52*	*340*	*31*

* Carotene content shown in italics.

† S refers to starter mash; L to laying mash; and numbers 1, 2 and 3 to the feed manufacturers.



Rate of loss of vitamin A and carotene in commercial poultry mashes stored under normal farm or warehouse conditions.

similar to the concentrates used in the current experiment). He reported 80 to 100 per cent retentions in feeds stored for four months at 75°F. Reid, Daugherty and Couch (1955), using a concentrate in which the vitamin A was sealed in micro-crystalline wax, showed in most instances 86 to 100 per cent retention when stored for four months under similar conditions.

The stabilised concentrates used in the feed mixtures tested in this investigation were, under summer storage conditions, at least as stable as those studied by other workers.

Natural carotene in the mashes dropped to as low as 16 per cent of the original level after six months storage. Since carotene is not stabilised and has a large exposed surface area, it would be expected to break down more rapidly than stabilised vitamin A. Because stability of carotene is poor and the amount in the main sources (lucerne meal and maize meal) varies widely, it is wise to disregard the possible carotene content and add all the vitamin A requirement in stabilised form.

The rates of loss of vitamin A in the feed mixtures tested are significantly different, but there is no evidence that the difference depends on initial level, source of vitamin A, or type of mash. The vitamin A contents decreased by as much as 15 per cent in three months and 26 per cent in six months; these losses should be taken into account in feed formulation.

Acknowledgements

The co-operation of stockfeed manufacturers who supplied samples and technical information is gratefully acknowledged. I also

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To Make on a Winter Evening—

NINA MARTINDALE

HERE IS SOMETHING to occupy one of those long winter evenings in front of the fire, and which will be sure to please some small child. To make it you'll need:

Cardboard (thin and pliable);

paste;

felt;

cotton to match (also black and white for eye embroidery);

fine needle and pins;

stuffing (preferably kapok or cotton wadding);

wire (15 in. approx.)—pliable but firm say, No. 10 fencing wire);

ball point pen or sharp drawing pencil; knitting needle; and

black leather (old glove) or plastic, for bill and claws.

If leather glove is soft use two pieces glued and pressed together for each claw.

Preparation

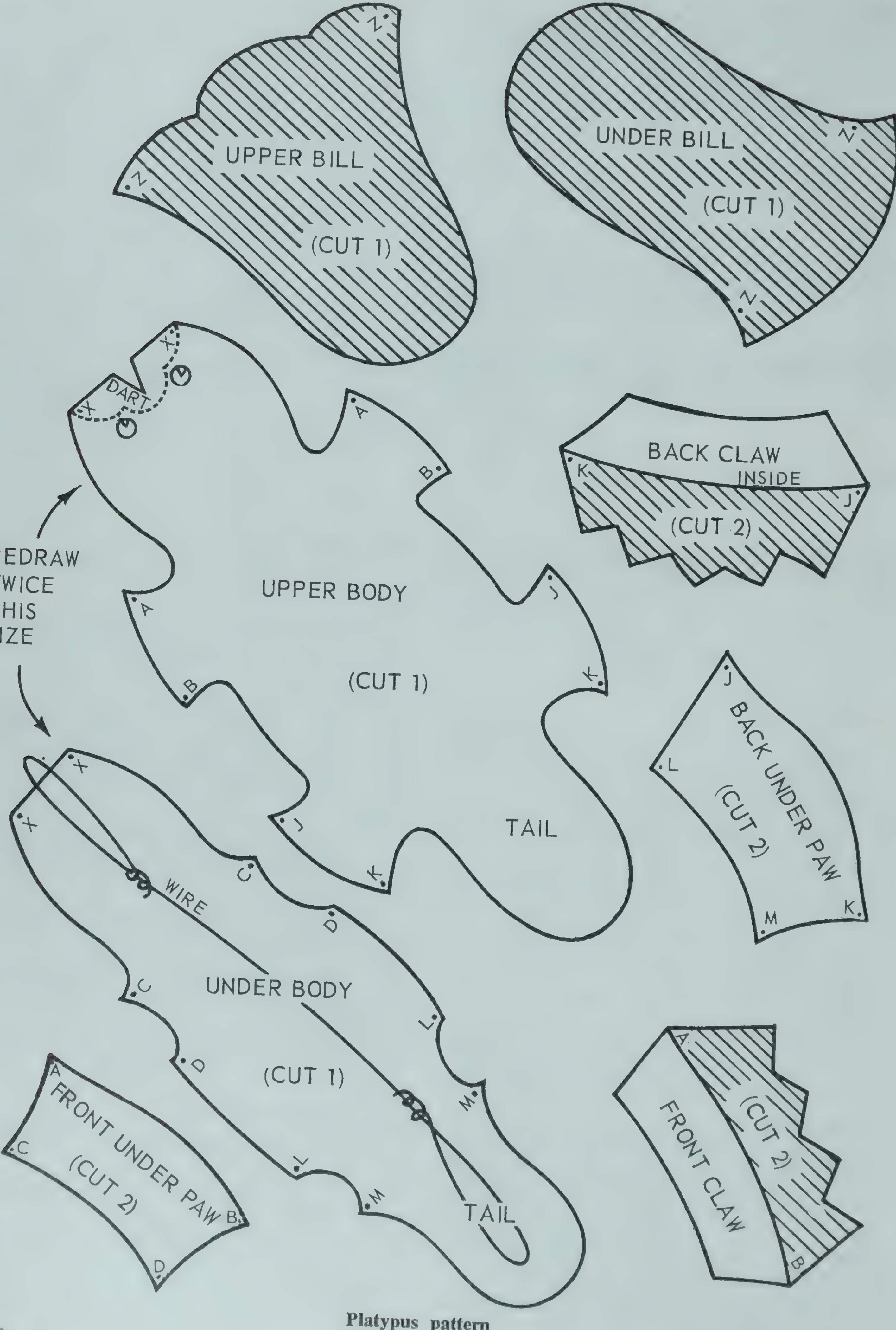
Enlarge the two main sections of the pattern to twice the size shown, then paste the pattern pieces on to the cardboard. When dry, cut out very carefully on the inside of the outline. Keep pattern pieces clipped together with a paper clip.

Using ball point pen or sharp drawing pencil outline the pattern pieces on felt.

Instructions

1. Glove stitch upper and under parts or bill from Z to Z.
2. Glove stitch front under paws to under body from C to D, slightly stretching under body curve.
3. Attach back under paws, L to M, in same way. *Special note*: When joining upper and under body, glove stitching of these paws must be on the inside of the animal.
4. Lightly catch the four black claw pieces to under body paw pieces at points A, B, J and K.
5. Pin upper to under body at tail with one fine pin for easier handling.
6. Stab stitch the four upper paw pieces to the four under paw pieces from A to B, and J to K.
7. Glove stitch dart in head on wrong side.
8. Embroider eyes.
9. Glove stitch upper to under body from X to A on both sides.
10. Slip bill over head until it covers the dart.

The Author: Mrs. Nina Martindale, Senior Extension Officer (Women's Service), Farrer Place, Sydney.



Platypus pattern

11. Attach beak to body using *"flat"* glove stitch, and stitch upper part first.

12. Glove stitch tail together from M to M.

13. Glove stitch *one* side from B to J.

14. Make a $1\frac{1}{2}$-inch loop and a 2-inch loop at either end of the wire—making sure ends are flat.

15. Stuff almost one half firmly.

16. Insert looped wire with larger loop in tail.

17. Continue stuffing until very firm, being sure wire is well covered on all sides.

18. Glove stitch the opening.

Note: To enlarge the two main body pieces to twice the size shown in the pattern: trace the parts on to a sheet of paper marked into half-inch squares. On another sheet of paper, draw a grid of one-inch squares. Simply copy the pattern, square by square, from the pattern on the small grid, on to the squares of the large grid.

Only these two parts need to be enlarged; all the other parts of the pattern are already the right size. ●

Flame-proofing for Home Safety

NINA MARTINDALE

THE OLD SAYING "prevention is better than cure" is certainly applicable to fire in the home.

Play safe—be safe! Prevent possible nasty burns. Make your child's frock or romper suit or pyjamas, your own aprons and your pot holders flame resistant by a do-it-yourself-method at home.

First launder the article or garment to remove dirt and possible grease. Dry thoroughly before immersing in the flame-proofing solution. Wring out gently and dry before pressing with a moderately hot iron.

For pot holders, aprons and curtains:

> Dissolve 7 oz. borax and 3 oz. boracic acid in 2 quarts of hot water. Bottle and label for use.

The Author: Mrs. Nina Martindale, Senior Extension Officer (Women's Service), Farrer Place, Sydney.

For children's garments:

> Dissolve 10 oz. borax and 8 oz. boracic acid in 1 gallon of hot water. Bottle and label for use.

Warning

Be well aware that flame-proofing treatment *is not* fire-proofing. All fabric articles and garments dipped in this solution will smoulder if and when exposed to direct flames.

Remember to repeat the flame-proofing treatment for each article after each wash.

Flame-proofing lasts as long as the articles do not get wet accidentally between their regular washes. When pressing, avoid using steam, as this will weaken the proofing. Too hot an iron will make the solution stick. If this happens use a damp cloth to clean the surface of your iron.

Make flame-proofing a regular habit and play safe at home. ●

COUNTRY COOKING

MRS. E. R. BROMLEY of "Bimadeen", Muswellbrook, is well known for her talent in the culinary field. She is also a very active artist, and leads a group of enthusiastic Muswellbrook aspirants in art. Her husband, Mr. E. R. Bromley, is President of the Muswellbrook Wine and Food Society.

Here is one of Mrs. Bromley's favourite recipes.

Paella (Chicken with seafood)

Serves four

1 frying chicken
3 dessertspoons plain flour
salt and pepper
3 dessertspoons cooking oil
2 dessertspoons butter
2 medium onions finely chopped
4 to 5 shallots
4 tomatoes, peeled and chopped
1 green pepper, cut in small pieces
1 red pepper, cut in small pieces
$\frac{1}{3}$ cup pitted olives, chopped — black olives for preference
$\frac{1}{3}$ cup seedless raisins
1 bay leaf
1 clove
$\frac{1}{4}$ cup chopped parsley
1 (or more) bottles oysters
$\frac{1}{2}$ lb. prawns
2 oz. sherry

Cut chicken in four pieces and remove skin. Shake pieces in a strong paper bag with the flour and seasoning. Heat oil and butter in fry pan or suitable large saucepan; cover and brown chicken lightly. Add onions and shallots and cook until golden; add tomatoes and all ingredients except oysters and prawns. Cover and simmer for 30 minutes.

When chicken is thoroughly cooked, remove bones and return flesh to sauce. It is important that the consistency should be juicy, not dry or thick.

Five minutes before serving add the oysters and prawns, correct seasoning, then stir in sherry. Serve with saffron rice.

NOTE: If sauce becomes too thick it can be diluted by using chicken stock, or chicken soup cubes made into stock. If oysters and prawns are not available, tinned ones can be used, saving juice for the saffron rice (Mrs. Bromley always boils up legs, neck and giblets to make the necessary stock).

Mrs. E. R. Bromley

Saffron Rice

1 cup long grain rice
3 dessertspoons butter
$\frac{1}{2}$ teaspoon salt
$\frac{1}{2}$ teaspoon saffron
$1\frac{1}{3}$ cups water, chicken stock or stock made with chicken soup cubes

Thoroughly wash rice in cold water. Drain, place in saucepan with butter, salt, saffron and water or stock. Stir until mixture boils; immediately reduce heat to simmering and cover tightly. DO NOT TOUCH OR OPEN COVER FOR 18 MINUTES. Open then and stir. If you prefer rice to be drier put it in a well-buttered ovenproof dish, cover, and put in oven.

To ensure that saucepan is airtight when cooking the rice, put a small tea towel over the lid when placing it on the saucepan. ●

Foliage and Bark in Garden Design

R. H. Anderson

We appreciate the value of flowers, but most shrubs bloom only for a few weeks or months, the *foliage* being the permanent part of the garden.

In choosing shrubs, trees or perennials it pays to remember this point, and select some plants which have attractive foliage and are not dependent on flowers alone for their beauty.

Texture as well as colour of foliage is becoming increasingly important in landscape design. We can use delicate, feathery foliage, massive foliage or variously shaped leaves in such a manner as to produce very attractive effects.

Plants with good foliage do not depend on flowers alone, and have a satisfying appearance throughout the year. Camellias, for example, have strong glossy leaves which are always attractive and add substance to the garden. The fine, feathery foliage of Tamarix can soften the bolder foliage of its neighbours in the shrubbery. The large, vigorous leaves of Acanthus have attracted interest from the time they were used as a basis for the decorating of the Corinthian columns.

Coloured or variegated foliage, of course, has always found wide uses in carefully designed gardens, giving relief to the possible monotony of green. There is a wide choice in variegated plants, including golden and silvery tones, apart from the coloured leaves such as Berberis and Prunus. Don't overlook the many useful variegations and colours in the conifers which vary from tall trees to miniature shrubs. Texture and colour of foliage can also be used in annuals. Apart from well known coloured foliaged plants such as Coleus, consideration can be given to Summer Cypress or Burning Bush, Red Castor Oil Plant, Variegated Maize, Kale, Snow on the Mountains and Dusty Miller.

In addition to the foliage, I feel we often overlook the importance of stem and bark appearance on trees. In some trees this can be one of their main attractions—the silvery white trunk of the Birch, the clean freshness of Lemon Scented Gum, the changing hues of the smooth-barked Angophora culminating in a glorious pink.

One of the most fascinating trees in the Royal Botanic Gardens, Sydney, is the Long-leaved Himalayan Pine, with its fantastically tessellated bark which in certain lights and times of the year has unforgetable colour.

Some shrubs or small trees too have interesting coloured barks. The red stems of the Strawberry Tree and the golden stems of the Yellow Willow are cases in point.

So when planning your garden, remember the claims of attractive foliage and barks. •

The Author: Mr. R. H. Anderson, former Director and Chief Botanist, Royal Botanic Gardens, Sydney (now retired).

TUBERCULOSIS-FREE HERDS

The following herds have been declared free of tuberculosis in accordance with the requirements of the scheme for certifying herds tubercle-free, and unless otherwise declared, this certification remains in force until the date shown in respect of each herd.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Australian Missionary College, Cooranbong (Jerseys)	123	Sept., 1965
Beddie, R. H., Old Grenfell Road, Forbes (Shorthorns)	124	Mar., 1965
Bonnington, R. A., "Leiroy", Shorthorn Stud, "Spring Camp" Curban (Beef Shorthorns)	77	Nov., 1965
Burke, J. & M. P., "Golden Valley", Forbes Road, Cowra (Beef Shorthorms)	57	Apr., 1967
Burnside Presbyterian Orphan Homes, North Parramatta (A.I.S.)	70	July, 1965
Cochrane, R. & C. C., "Parrabel Stud", Bega (Jerseys)	160	April, 1965
Del La Salle College, Castle Hill (Ayrshires)	46	July, 1966
Eather, A. D. & J., "Milgarra", Bunnan (Beef Shorthorns)	65	Sept., 1965
Ewin, N., "Edenview", Greghamstown, via Blayney (A.I.S.)	60	May, 1965
Fairbairn, C. P. & C., Woomargamma Stn., Hume (Beef Shorthorns)	549	Nov., 1966
Farrer Memorial High School, Nemingha (A.I.S.)	93	May, 1964
Fleming, T. H. & Sons, "Russley", Aberdeen (Polled Shorthorns)	337	Aug., 1965
Franciscan Missionaries of Mary, Range Road, Mittagong (Friesians)	92	Mar., 1966
Freudenstein, F. J. & G. F., "Chippendale", Grenfell Road, Young (Beef Shorthorns)	89	June, 1966
Freudenstein, W. J. A. & Son, "Chippendale", Grenfell Road, Young (Beef Shorthorns)	133	June, 1966
Glen Mitchell Pastoral Co., Wellington (Poll Shorthorns)	170	April, 1966
Grafton Experiment Farm, Grafton (A.I.S., Angus)	436	Aug., 1965
Greaves, J. A., "Baroona", R.M.B. 63, West Wyalong (Beef Shorthorns)	44	Nov., 1965
Grey, T. J., Estate, "The Meadows", Albion Park (Jerseys)	147	Sept., 1966
Hawkesbury Agricultural College, Richmond	247	June, 1965
Hill, R. H. and Sons, Bulliac (A.I.S., Jerseys)	71	Oct., 1964
Hurlstone Agricultural High School, Glenfield (Ayrshires)	67	Aug., 1965
Limond Bros., Morisset (Ayrshires)	99	Aug., 1965
McSweeney, W. J., "The Rivers", Canowindra (Polled Shorthorns)	83	May, 1965
Maloney, D., "Heathvale", Broadwater (Jerseys)	46	Sept., 1966
Markham, J. & E., "Mara", Branxton (Jerseys)	57	Aug., 1965
Mullee Stud Farms Pty. Ltd., "Nairobi", Scone (Poll Herefords)	123	May, 1966
Mutton, J. T. & Sons, Bolwarra, Maitland (Jerseys)	100	Feb., 1965
O'Dea, C., "Sunnyside", Nepean Stud, Nth. Richmond (Friesians)	107	Mar., 1967
Peel River Land and Mineral Co., "Goonoo Goonoo", Tamworth (Polled Shorthorns)	412	Oct., 1966
Pratt, H. F., "Field View", Reserve Creek via Murwillumbah	127	Nov., 1966
Reid, D. B., "Evendale", Sutton Forest (Angus)	179	Dec., 1966
Reid, G. T., "Narrengullen", Yass (Angus)	540	June, 1965
St. Vincent's Boys' Home, Westmead (A.I.S.)	16	June, 1965
Simpson, F. S., "Gunnawarra", Gulargambone (Beef Shorthorns)	238	Aug., 1965
Simson, J. N., "Nowley", Spring Ridge (Shorthorns)	227	Feb., 1966
The Scots School, Bathurst (Friesians)	31	Nov., 1965
Registered Stud Herds—*continued*		
Training Farm for Boys, Berry (A.I.S.)	122	Jan., 1966
Trangie Agricultural Research Station, Trangie (Angus)	175	May, 1966
Vitnell, A., Dalwood (A.I.S.)	120	Feb., 1967
Wagga Wagga Agricultural College (Jerseys, Poll Shorthorn)	167	May, 1965
Walsh, Mrs. H. R., "Water View", Cowra (Beef Shorthorns)	127	Mar., 1967
Waters, G., "Willow Dell" Jersey Stud, "Boongala", Deniliquin	139	Mar., 1965
White, H. F., Bald Blair, Guyra (A.A.)	147	June, 1965
Willis, R. N. & D. M., Westbrook, Mt. Hunter, via Camden (Ayrshire)	207	Nov., 1966
Wollongbar Agricultural Research Station, Wollongbar (Guernseys, A.A.)	140	June, 1965
Wombramurra Pty. Ltd., "Wombramurra", Nundle (Devon)	136	April, 1966
Wright, Miss I. M., "Awatea Jersey Stud", Paddy's Plains, North Dorrigo	54	Dec., 1966
Yanco Agricultural High School, Yanco (Jerseys)	127	Oct., 1965
Yanco Agricultural Research Station (Jerseys, Guernseys)	115	Dec., 1965
Herds Other than Registered Stud Herds		
Adams, B. & L., "Garryowen", Wallamore Rd., Tamworth	59	Nov., 1965
Adastra Dairies Pty. Ltd., Terrace Rd., North Richmond	106	July, 1966
Baker, R. W., Luskintyre, Lochinvar	74	Oct., 1966
Barnardo's Homes, Dr., Tooloogan Vale, Scone	146	Feb., 1967
Bennett, J. F. M., "Oaklands", Pambula	90	May, 1965
Bethsam Holiness Mission, Wyee	17	Feb., 1967
Bladwell, W. R., "Loloma", Goulburn	128	Dec., 1965
Bowen, A. H., Stroud	73	April, 1966
Bridge & Bowden, Mill Creek, Stroud Road	47	April, 1965
Brookfield Afforestation Camp, Manus	291	May, 1966
Brown, R., Valery	58	Aug., 1965
Charlton, R. J., Caniba Street, Lismore	66	Dec., 1965
Chesham, C. H., Picton Road, The Oaks	42	April, 1967
Child Welfare Dept., "Werrington Park", St. Marys (A.I.S.)	37	Feb., 1966
Coilsfield Pty. Ltd., "Coilsfield", Orange	244	Dec., 1965
Cole, E. J. & Sons, Lochiel	127	April, 1966
Cole, G., South Pambula	53	Oct., 1965
C. V. and H. G. Denton, "Yarrawood Farm", Merimbula	91	May, 1965
Croagh Patrick Orphanage, Park St., Orange	61	Feb., 1966
Dunsire, Mrs. T., "Glenara", Riverview Rd., Lansvale	164	May, 1966
Ellensville Est., "Ellensville", Glenmore, via Camden	154	Dec., 1966
Ellwood, H., Attwater Avenue, Cessnock	61	Mar., 1966
Enright, M. (Mrs.), "Hinton Vale", Hinton	95	June, 1966
Fairbridge Farm School, Molong	73	Jan., 1966
Farley, D. J., Stroud	88	Dec., 1965
Foley, L. F., Lucknow, via Orange	29	Dec., 1965
Forster & Sons, "Abington", Bundarra	53	April, 1966
Franciscan Fathers, Maryfields, Campbelltown	50	April, 1966
Gilbert, A. E, Mill Creek, Stroud	117	Aug., 1966
Gorton, I. E., Stroud Road, N.S.W.	76	Dec., 1966
Greenham, J. R., Hill Creek, Stroud	45	Sept., 1965
Harrington, J. B. & J., "Mt. Erin", Campbelltown	97	Nov., 1965
Harrington, P. P., "Glen Erin", Leumeah	69	Nov., 1965
Hawkey, H. R., "Trevone", Menangle	271	Nov., 1964

Tuberculosis-free Herds—continued

Owner and Address	Number Tested	Expiry Date
Herds Other than Registered Stud Herds—*continued*		
Hawkins, G. A., Freemans Reach	67	Mar., 1967
Her Majesty's Training Centre, Emu Plains	151	Feb., 1966
Her Majesty's Training Centre, Goulburn	29	Mar., 1966
Hill, W. S., " Questwill ", Crooked Lane, North Richmond	55	July, 1966
Hill, R. H. & Sons, Bulliac	107	Oct., 1966
Johnson, J. R. & P. M., Wallamore Road, Tamworth	123	July, 1965
Kenmore Hospital, Kenmore	135	Mar., 1966
Lee, G. N., Taree	62	Nov., 1966
MacArthur Stanham Holdings Pty. Ltd. Camden Park, Menangle	279	Mar., 1966
McGrogan, J., Percy Street, Singleton	83	Jan., 1967
Margery, G. W., Stroud Road, Stroud	68	Aug., 1965
Merchant, Mrs. P., East Gresford	85	Dec., 1965
Moffit, C. E., Central Tilba	161	Dec., 1965
Monkittee Pastoral Co., Braidwood	47	Nov., 1965
Morisset Hospital, Morisset	89	Mar., 1967
Moxham Bros., " Mullengudgery ", Mullengudgery	112	Dec., 1966
Mt. Penang Training School (Gosford Farm Homes), Gosford	68	May, 1965
Naroo Pastoral Co. Pty. Ltd., " Jemalong ", Forbes	403	Jan., 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong	101	Sept., 1965
Odewahn, R., 113 Argyle St., Parramatta	20	Sept., 1965
North Parramatta Psychiatric Centre	48	Aug., 1965
Passionist Fathers, Mary's Mount, Goulburn	22	Mar., 1966
Perry, K. T., Millingandi, via Eden	69	July, 1965
Pitt, S. R., Wylie's Flat, via Singleton	44	July, 1966
Ramsey, E. J., " Manor Park ", Parkes	72	Feb., 1967
Ryan, P., Hallsville	33	July, 1965
Rydalmere Hospital, Rydalmere	28	Nov., 1965
Scott, S., Mullumbimby	71	Sept., 1966
Shelldrake Bros., " Clearview ", Box 11, Picton	93	Nov., 1966
Simpson, A. T., " Kenso ", Forest Road, Orange	191	April, 1966
Stinson, J. B., Church Lane, Castlereagh	88	Oct., 1966
St. John of God Training Centre, Morisset	22	Sept., 1965
St. John's Orphanage, Goulburn	9	Mar., 1966
St. Joseph's Orphanage, Cowper	77	Nov., 1966
St. Joseph's Orphanage, " Kenmore ", Goulburn	9	Mar., 1966
St. Joseph's Orphanage, Kincumber	39	April, 1966
Sternbeck, C. H., Laguna House, Laguna	145	April, 1967
Sydney Church of England Grammar School, Moss Vale (Jerseys)	210	Nov., 1966
Taylor Bros., Tathra Road, Bega	145	Nov., 1965
Tegel, A. A. Pty. Ltd., Heath Road, Leppington	92	Nov., 1966
Thompson, L. K., " Redbourneberry ", Singleton	57	Mar., 1967
Turner, R. G., " Merriwinga ", Tilba Tilba	67	Sept., 1965
Training School for Boys, Mittagong	91	Feb., 1966
United Protestant Association, " Sunny Lands ", Wollongbar	39	Nov., 1966
Whelan, W. G., Kiah, via Eden	62	Nov., 1966
Whelan, W. R., Bulahdelah	56	April, 1966
Wiley, F. J., Candelo	12	June, 1965
William Thompson Masonic School, Baulkham Hills	66	Sept., 1965
Williamson, R. J., Fattorini Island, Gladestone, N.S.W.	55	April, 1966
Wilson, A. J., Nicholls Street, Stroud	57	Nov., 1965
Wilson, K., Woodlawn, via Lismore	51	Sept., 1966
Wood, Mrs. J., Redbourneberry, Singleton	16	Sept., 1966
Youth Welfare Association of Australia, Hopewood, Bowral	241	Dec., 1966

R. A. HALL, Chief, Division of Animal Industry.

Brucellosis-free Herds (Cattle)

The following herds have been declared free of brucellosis in accordance with the requirements of the scheme of certifying herds brucellosis-free.

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Burke, J. and M. P., " Golden Valley ", Cowra (Beef Shorthorn)	58	April, 1965
De La Salle College, Oakhill, Castle Hill (Ayrshire)	46	July, 1965
Hurlstone Agricultural High School, Glenfield (Ayrshire)	67	Aug., 1965
McSweeney, W. J., " The Rivers ", Canowindra (Poll Shorthorns)	83	May, 1965
" Womramurra ", Pty. Ltd., Nundle (Devon)	135	May, 1965
Herds Other than Registered Stud Herds		
Fairbridge Farm School, Molong	73	Feb., 1966
Mt. Penang Training School, Gosford	62	June, 1965
St. John of God Training Centre, Morisset	22	Feb., 1966
Training School for Boys, Mittagong	91	Feb., 1966

R. A. HALL, Chief, Division of Animal Industry.

Brucellosis-free Herds (Swine)

The following is a list of names and addresses of owners of herds which have been declared brucellosis-free in accordance with the requirements of the Brucellosis-free Herd Scheme (Swine).

Owner and Address	Number Tested	Expiry Date
Registered Stud Herds		
Boyle, W. R., Alford Point Road, Menai (Tamworth and Berkshore)	15	June, 1965
Campbell, D. C., "Hillangrove Stud", Wamberal (Large White)	18	Feb., 1966
Carter, P. L., Woorak Stud, Pine Ridge, via Quirindi (Tamworth & Large White)	37	July, 1965
Draper, R. E., "Glengar", Capertee (Tamworth)	6	Nov., 1965
Farrer Memorial Agricultural High School, Nemingha (Berkshire) ..	11	April, 1966
Grafton Experiment Farm, Grafton (Berkshire)	15	April, 1965
Hawkesbury Agricultural College, Richmond	55	Mar., 1965
Hurlstone Agricultural High School, Glenfield (Berkshire)	7	Sept., 1965
Registered Stud Herds—*continued*		
Lambeth, A. J., "Talanga", Douglas Park (Berkshire)	11	May, 1965
Maxwell, J. D., "Brooklyn", Barmedman	10	July, 1965
Mt. Penang Training School, Gosford (Berkshire)	10	June, 1965
N.S.W. Police Citizens Boys' Club, Camp Mackay, Kurrajong (Berkshire)	7	Aug., 1965
Wagga Agricultural College (Berkshire, Tamworth and Large White)	22	Sept., 1965
Wollongbar Agricultural Research Station, Wollongbar (Tamworth)	29	July, 1965
Yanco Agricultural High School, Yanco (Berkshire)	19	Sept., 1965
Herds Other than Registered Stud Herds		
Brookfield Afforestation Camp, Mannus	15	April, 1966

R. A. HALL, Chief, Division of Animal Industry.

Areas Undergoing Regular Testing for Tuberculosis

Quarantine Areas (Tuberculosis)—Urban Areas

The following areas have been declared quarantine areas to ensure that a tubercle-free milk supply is available to residents. No cattle from which milk or milk products are obtained for human consumption are allowed to be kept therein unless subjected to the tuberculin test and found free from tuberculosis:

Barraba
Bingara
Braidwood
Casino
Condobolin
Cooma
Coonabarabran
Coonamble
Crookwell
Cudgegong
Glen Innes
Goobang
Grenfell
Griffith
Inverell
Junee
Kempsey
Manilla
Moree
Muswellbrook
Nyngan
Parkes
Queanbeyan
Tullamore
Walgett

Quarantine Areas (Tuberculosis)—Eradication Areas

The following areas have been declared quarantine areas for the purpose of eradicating tuberculosis from cattle contained therein. All owners are required to have all their cattle tested for tuberculosis when notice for testing is served:

Allyn
Bega
Bellingen
Bodalla
Brushy Hill
Burringbar
Busby's
Caniaba
Cessnock
Chichester
Clybucca
Comboyne
Coraki
Cumberland
Denman
Dilkoon
Dorrigo
Dungog
Dyraaba
East Casino
East Kempsey
Eden Creek
Fawcetts
Gloucester
Grafton
Harwood
Illawarra
Kameruka
Kyogle
Lavadia
Lawrence
Lostock
Lower Hunter
Maclean
Maitland
Manning
Marshdale
Martindale
Milton
Moss Vale
Mullumbimby
Myrtle
Nabiac
Nambucca
Narooma
Nimbin
Nth. Hastings
Nth. Tweed
Orara River
Picton
Salisbury
Scone
Singleton
Southgate
South Lismore
Stewart's River
Tintenbar
Tyalgum
Ulmarra
Upper Macleay
Upper Richmond
Upper Wollomba
Warkworth
West Kempsey
Wingham
Wollombi Brook
Woodburn
Woodford Island

V. C. N. BLIGHT, GOVERNMENT PRINTER